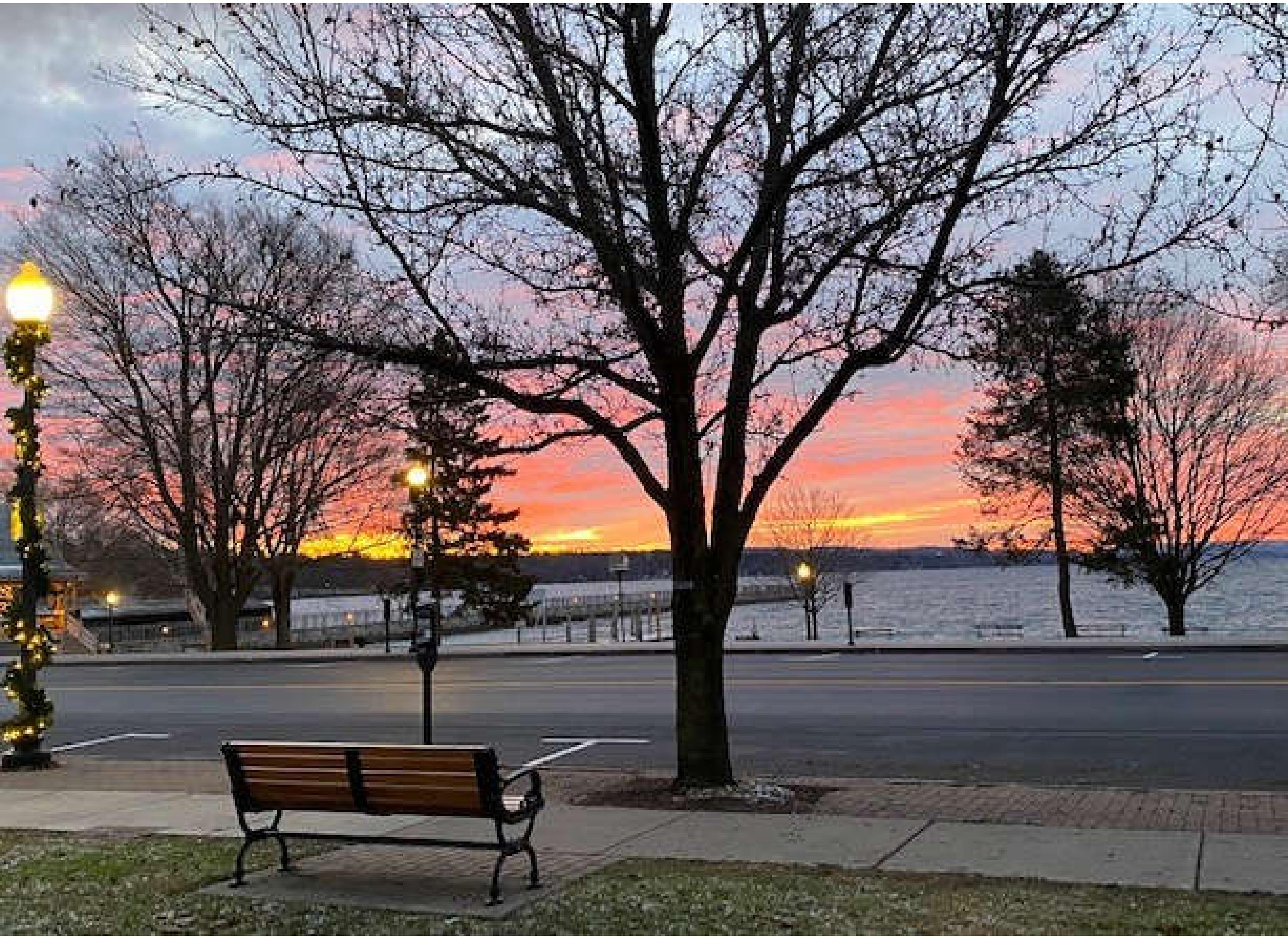
April, 2020



SKANEATELES LAKE AND WATERSHED
2019 ANNUAL REPORT

Volume XLV

Prepared By:
Richard Abbott
Water Quality Management
Department of Water
City of Syracuse, New York

CITY OF SYRACUSE
DEPARTMENT OF WATER
WATER QUALITY MANAGEMENT

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Cover Photograph by Robin McCowen

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1. SKANEATELES LAKE AND WATERSHED

1.1 General Lake and Watershed Characteristics

Skaneateles Lake lies within the Oswego River Drainage Basin. It is the fourth largest and third deepest of the Finger Lakes (Exhibit A) [1]. It has a surface area of 13.6 square miles and has a maximum depth of 300 feet. It was formed during the Pleistocene Era by glacial scour and morainic damming. Thus, the lake basin is very steeply sloped with a small littoral zone, and is "U" shaped. Approximately 80% of the lake's volume is below a depth of 30 feet.

The lake is dimictic, and complete turnover occurs twice per year (Spring and Fall). Strong stratification develops during the summer. In winter a weaker, inverse stratification develops: colder (and at times denser) water lies above warmer water. This occurs regardless of ice formation.

Skaneateles Lake is considered oligotrophic: it is low in nutrients and biological productivity. This is most likely a result of the small drainage basin to lake surface area ratio (4:1). Other features of oligotrophy include: (a) a deep, thick metalimnion resulting from greater light penetration, which forms during summer stratification, (b) an orthograde distribution of oxygen, also forming during summer stratification, (c) a blue-green color that demonstrates deep light penetration by the blue wavelengths due to the low concentrations of phytoplankton and humic substances, and (d) high transparency. The oligotrophic state of the lake makes it ideal for drinking water supply and recreation.

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. Generally, the elevation is higher and the slopes are steeper in the southern portion of the watershed as compared to the northern area (Exhibit A). The highest elevation is found in the southeastern watershed at 1980 feet above sea level (USGS). Watershed acreage calculated by the Geographic Information System (GIS) is 37,724 acres or 58.94 square miles [2]. The physical characteristics of the lake and drainage basin are summarized in Table No. 1.

Table 1 Skaneateles Lake and Drainage Basin Characteristics

Parameter	Value
Mean High Water Elevation*	863.27 Syracuse Datum
Mean High Water Elevation*	865.02 NVD
Length	15 Miles
Average Width	0.90 Miles
Maximum Depth	300 Feet
Mean Depth	145 Feet
Lake Surface Area	13.6 Square Miles
Drainage Basin Area (Land)	58.94 Square Miles
Drainage Basin: Lake Surface Ratio	4.33 : 1.0
Lake Volume	412 Billion Gallons
Highest Elevation*	1,980 NVD

* Feet Above Sea Level

[1] Lake data excerpted from: Effler, S.W., et al. 1989. Limnological Analysis of Skaneateles Lake, 1988. Upstate Freshwater Institute, Inc. Syracuse, NY

[2]

1.2 Watershed Soils

There are several soil associations within the watershed (Exhibit B and Table No. 2). The associations discussed below account for 80% of the watershed area and are considered representative of the character of the watershed. The remainder (20%) will not be discussed. It is noted that the associations generated by the GIS compare well, though not exactly, with the U.S. Department of Agriculture Soil Surveys prepared for each county. It would appear that this is due to the inherent discrepancies often found between maps and mapping systems.

The major soil associations found in the northern two-thirds of the watershed are: Honeoye-Lima, Lansing-Conesus, Honeoye-Lansing, and Aurora-Angola-Darien. These associations are generally characterized as deep, medium textured silt loams and gravelly silt loams. Slopes range from 2-8%, except the Honeoye-Lansing Association that has slopes of 15-25%. They are moderately well, to well drained. Permeability is slow to moderate, and seasonal ground water is generally 15” to <36”.

The Langford-Erie Association comprises the southwestern portion of the watershed (about 15% of the watershed). It is considered a deep, medium textured silt loam with slopes from 2% to 25%. The soils are poorly to well drained, and slowly to moderately permeable. A medium textured fragipan can be observed in some areas. Seasonal ground water and bedrock are shallow at 6” to 20”, and 20” to 40”, for the Langford and Erie series, respectively.

There are three (3) associations found primarily within Cortland County (southeastern portion of the watershed): Valois-Langford-Lansing, Volusia-Mardin-Lordstown, and Lordstown-Volusia-Mardin. This is equivalent to about 13% of the watershed. 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 ground water ranges from 18” to 60”.

Typically, the soils of the watershed are gravelly to medium-textured silt loams that were formed in glacial till. Slopes are generally 2-25%, but can exceed 55% in the southern portion of the watershed. The soils are poorly to moderately well drained, and very slowly to slowly permeable. 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.

Table 2 Soils of the Skaneateles Lake Watershed

Association	County	Percent of County	Dominant Location in Watershed	Percent of Watershed	Slope	Soil Type and Seasonal Ground Water	Drainage/ Permeability
Honeoye-Lima	Onondaga	39%	West & North West 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 North East 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%		Poorly to moderately well drained
Langford-Erie	Cayuga	45%	South Cayuga	15%	2-25%	Deep, medium textured silt loams Groundwater: 6-20”	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
Volusia-Mardin-Lordstown			Uplands				
Lordstown-Volusia-Mardin			Hewitt Forest				

1.3 Demographics, Land Use and Land Ownership

The watershed population totals approximately 4,487 people residing in 2,941 dwelling units (Table Nos. 3 and 4) [3]. Of the total number of dwelling units, approximately 1065 are lakeshore dwellings. Land ownership is estimated as 52% private/residential (developed or vacant), 37% agricultural, 9% public and 2% commercial (Table No. 5). Based upon the GIS land use coverages, land use is calculated as: 48.2% agricultural; 40.3% open/forest; 5.4% residential; 4.7% brush; 0.9% other development; 0.3% ponds; 0.2% commercial (Table No. 6). Land use is defined as land cover acreage derived from the aerial orthophotographs.

Political subdivisions within the watershed include parts of three counties and seven townships. However, two of the towns, Marcellus and Owasco, account for less than 300 acres (or < 1.0% of the total watershed area). Onondaga County accounts for 51% of the watershed land area and 74% of the watershed population. Within the county are parts of the Towns of Skaneateles and Spafford, and the Village of Skaneateles. Forty-five percent (45%) of county lands are owned by the agricultural community. Of the estimated 2,148 dwelling units within the county, approximately 298 are connected to the Village of Skaneateles sanitary sewer system. The Village is the only municipality in the watershed having a public sewer system. The remaining watershed homes use Onsite Wastewater Treatment Systems (OWTS) or holding tanks for waste dispersal or collection (discussed in subsequent sections of this report). 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. Most buildings are 3-5 story structures. Various businesses occupy the ground level floors of these buildings, and a number of apartments/inhabitants occupy the upper stories.

Cayuga County accounts for 34% of the land and 10% of the population within the watershed, which includes two towns, Niles and Sempronius. Agricultural lands account for 29% of the county land area. Most of the residential development in this county is on the lakeshore and is predominantly seasonal. Much of the shoreline is very steeply sloped.

Cortland County accounts for 15% of the watershed. The Town of Scott is the single town within this portion of the watershed. It has a population of 706 or 16% of the total watershed population. Soil conditions and extreme topography of the area limit development. Farming accounts for 28% of the watershed land area.

Table 3 Skaneateles Watershed Population Distribution and Watershed Land Area by Town

Town	Dwelling Units	Population	Percent of Total Population	Percent of Watershed Land Area
Skaneateles	1,414	2,406	53.6%	26.0%
Spafford	734	908	20.2%	25.0%
Niles	389	388	8.7%	17.0%
Sempronius	88	79	1.8%	17.0%
Scott	316	706	15.7%	15.0%
Totals	2,941	4,487	100%	100%

Data supplied by the Syracuse-Onondaga County Planning Agency, October 2011

Table 4 Skaneateles Watershed Population Distribution and Watershed Land Area by County

County	Dwelling Units	County Population	Percent of Watershed Population	Percent of Watershed Land Area	Density People/$mile^2$
Onondaga	2,148	3,314	73.9%	51%	110.1
Cayuga	477	467	10.4%	34%	23.4
Cortland	316	706	15.7%	15%	79.9
Totals	2,941	4,487	100%	100%	71.1*

* Average density

Table 5 Land Ownership in the Skaneateles Watershed

Land Ownership	Acres	Percent of Total
Agricultural	13,734	37%
Public	3,575	9%
Commercial	672	2%
Residential/Private	19,740	52%
Total	37,720	100%

* Revised 2004

Table 6 Land Use in the Skaneateles Watershed

Land Use	Acres	Percent of Total
Agricultural	18,191	48.2%
Commercial	58	0.2%
Residential	2,029	5.4%
Forest/Open	15,212	40.3%
Brush	1,792	4.7%
Pond	116	0.3%
Other Development	322	0.9%
Total	37,720	100.0%

1.4 Skaneateles Lake Watershed Water Budget

The Skaneateles Lake Watershed receives an average 42.67" of precipitation per year. Of this amount approximately 50% of the total precipitation produces runoff, or yield, to the lake [4,5]. Yield or runoff is the actual amount of water that reaches the lake as a result of precipitation. The yield coefficient (also called the hydrologic response coefficient) is an expression of the proportion of precipitation that reaches the lake.

Expressed as volume, annual precipitation produces approximately 53 billion gallons of water [6]. The runoff (26 billion gallons) provides the equivalent of about 9 feet of lake elevation (2.836 billion gallons/foot) [7]. Approximately one-third of the yield is precipitation that falls directly onto the lake surface, i.e., water that does not flow across or percolate through the soil before entering the lake. This is important to take into consideration when attempting to determine potential contaminant loading to the lake, since not all yield can be attributed to surface or sub-surface runoff. The remaining 26 billion gallons (50% of the total precipitation) is the net loss due to evapotranspiration, soil moisture recharge and groundwater recharge.

Of the total yield produced, the Water Department utilizes about 13 billion gallons per year for water supply to the City. The Village and Town of Skaneateles use approximately 0.27 billion gallons. About 9.0 billion gallons are discharged through the outlet of the lake to Skaneateles Creek. The latter is done in order to maintain elevations that satisfy the many uses of the lake: public and private water supply, storage for seasonal runoff, fishery spawning areas and recreation.

Three criteria are used to determine the rate of discharge through the lake's outlet for lake elevation management. 1: current levels as compared to the drawdown guideline levels 2: current rates of precipitation 3: the amount of water stored in the snowpack. For the latter, cores of snowpack at eighteen (18) locations within the watershed are analyzed weekly for water content.

1.5 Watershed Precipitation, Yield, Lake Level and Dam Discharges

The lake elevation on January 1st was 862.51, below the Monthly High Drawdown Guideline Desired Range of 861.75. Snowfall for the month totaled 34.05" (av. 23.03"). As a result of the high lake level and above average snowfall, dam discharges were elevated throughout the month, averaging 181.21 MGD, significantly above the monthly average of 40.50 MGD.

Snowfall totals for February and March totaled 19.00" (av. 21.66") and 18.25" (15.01") respectively. March precipitation was below average at 2.14" (av. 3.24"). Dam discharges averaged 207 MGD (av. 36 MGD) for February. The lake level on March 7 was 861.85, within the Monthly Drawdown Guideline Desired Range. As a result, dam discharges were reduced from 199 MGD to 25 MGD. Discharges for the month averaged 79 MGD. The increase in lake elevation for March was minimal at .04'.

Precipitation totals were above average in April and May at 4.21" (av. 3.54") and May, 5.31" (av. 3.67") respectively. The lake elevation increased .61 feet in April, from 861.97 (below the Low Monthly Drawdown Guideline Desired Range of 862.00) to 862.55 on April 30. Dam discharges averaged 40.63 MGD for the month. The lake elevation continued to rise through the first three weeks of May, cresting at 863.25 on May 20. Dam discharges were increased from 51 MGD on May 1, to 183 MGD by May 16 and reduced to 127 MGD by May 31. The lake elevation decreased to 862.89 on May 31, within the Monthly Drawdown Guideline Desired Range.

For the January-May period, precipitation totaled 18.76" (av. 15.84"). The yield and yield coefficient were 169.21 MGD (av. 118.56 MGD) and 1.07 (av. 0.89) respectively.

Snowfall total for the 2018-19 season was significantly above average at 105.50" (av. 88.46"). Measurable snowpack was recorded on nineteen (weekly) sample dates from November 2018 through April 2019.

June through August precipitation totals were all significantly above monthly averages. June totaled 5.75" (av. 3.95"), July was 5.51" (av. 3.97") and August was 5.91" (av. 3.81"). There were seven one-day precipitation events totaling .50" or greater. July precipitation events included five one-day events over .75". For the month of August, precipitation was recorded on 16 consecutive days, accounting for 88% of the monthly rainfall. Despite the above average summer rainfall, the lake elevation increased marginally (.26 feet), for the month of June, declined by .35 feet for July and declined .03 feet in August. Dam discharges for the summer months averaged 82 MGD in June, 40 MGD in July and eight MGD in August.

Precipitation for the June-August period totaled 17.17" (av. 11.77"). The yield and yield coefficient were above average at 81.71 MGD (av. 34.49 MGD) and .34 (av. 0.19) respectively.

The September 1 lake elevation was 862.70 (av. 861.45). Rainfall was below the monthly average at 3.02" (av. 3.99"). The lake elevation declined 0.56' for the month, resulting in a September 30 elevation of 862.15. June dam discharges averaged eight MGD.

Monthly precipitation for October totaled 7.59" (av. 3.99"). The above average monthly total included three 24 hour events greater the one inch. The 1.84" 24 hour storm on October 31 resulted in a .42 ft. rise in lake elevation by November 2. Dam discharges were increased twice in October; from 8.0 MGD to 32 MGD on October 22 and to 49 MGD on October 29.

December's precipitation total was 4.68" (av. 3.40"). The lake level on December 31 was 861.45, accounting for a .22 foot decrease in monthly lake elevation.

Precipitation for the September-December period totaled 16.96" (av. 15.12"). Yield for the period was 72.49 MGD (av. 47.61 MGD) and the yield coefficient was 0.41 (av. 0.28).

The Skaneateles Watershed received 52.89" of precipitation for the year (av. 42.69"). The average annual yield to the lake was 115.09 MGD (av. 73.89 MGD) with a yield coefficient of 0.62 (av. 0.49). Total discharge through the lake outlet for 2019 was 29,915 MG or 10.55 feet of elevation (av. 10,029 MG or 3.54 feet, respectively). A summary of the above information can be found in Table No. 7.

Table 7 Skaneateles Watershed Data

Month	Precipitation in Inches		Yield in MGD		Elevation Feet Above Sea Level *;**		Dam Discharges in MGD	
	68 Year Average	2019	68 Year Average	2019	68 Year Average	2019	68 Year Average	2019
January	2.74	4.34	81.85	194.73	860.73	862.51	40.50	181.21
February	2.64	2.77	100.86	207.67	860.68	862.27	35.68	206.96
March	3.24	2.14	154.17	123.44	860.87	861.93	36.97	79.07
April	3.54	4.21	166.05	138.98	861.64	861.97	50.38	40.63
May	3.67	5.31	89.86	181.21	862.38	862.58	35.78	116.58
June	3.95	5.75	61.07	147.29	862.47	862.82	20.51	81.23
July	3.97	5.51	31.70	49.20	862.40	863.08	20.50	40.02
August	3.81	5.91	10.69	48.63	862.00	862.73	13.02	7.62
September	3.99	3.02	12.51	0.33	861.45	862.70	11.31	7.98
October	3.99	7.59	27.34	91.99	860.97	862.14	12.10	17.25
November	3.73	1.69	61.95	78.17	860.64	862.50	20.43	115.34
December	3.40	4.68	88.64	119.46	860.62	861.69	33.13	99.05
Annual	**42.67**	**52.92**	**73.89**	**115.09**			**27.53**	**82.75**

* Syracuse Datum

** 1st Day of Month Lake Elevation

2. SAMPLING AND ANALYSIS

2.1 Turbidity Sampling and Analysis

The City of Syracuse Department of Water continued to operate under the guidelines of Title 10, Part 5 of the Official Compilation of Codes, Rules and Regulations of New York (10 NYCRR Part 5). All water quality criteria were met. Turbidity for each intake was recorded continuously using Hach 1720E turbidimeters (one per intake). The meters are calibrated routinely against readings taken on a Hach 2100N model. The latter is calibrated every three months using the formazin method outlined in *Standards Methods for the Examination of Water and Wastewater, 20th Edition.*

Readings were recorded by Water Plant personnel at four-hour intervals using the Hach 2100N turbidimeter and Hach 1720E continuously recording turbidimeters. The results were included in the monthly reports submitted to the New York State Department of Health (NYSDOH), and are summarized in Table No. 8 of this report. The 2019 average turbidity readings for Intakes #1 and #2 were 0.53 NTU and 0.52 NTU, respectively.

Figure 1 illustrates relatively stable annual turbidity averages at Intake #1 and #2 through 2019. Following a significant spike in the September average from 2012 – 2014 (Figure 2), the trend line declined significantly through 2016 resulting in turbidity recordings consistent with the long-term average. Spikes in 2017 and 2018 September turbidity averages did not reach averages recorded from 2012 – 2014, however, both years were above the long term averages.

Daily maximum turbidity measurements at Intake #1 over the period from 2004 through 2016 indicate that fluctuations in turbidity have become more pronounced beginning in 2009 (Figure 3). The turbidity range narrowed in 2017, resembling pre-2014 measurements. In 2019, maximum turbidity levels showed an increase from 2018, however, were significantly lower than 2017 levels. Since monthly average data can mask spikes in turbidity, Figure 4 illustrates the number of occurrences with a daily maximum turbidity over 1 NTU for each month from 2004 – 2019. Note that following four consecutive years (2012–2015) of elevated September occurrences, maximum turbidity did not exceed 1 NTU in September of 2016. Daily maximum turbidity above 1 NTU was recorded on 99 days in 2017, 57 days in 2018 and 63 days in 2019 at Intake #1. Eighty seven of the occurrences were between July and October in 2017 compared to only 41 occurrences within the same time frame in 2019 (Table No. 9).

Both Table No. 9 and Figure 4 display the variance in the number of days with maximum turbidity greater than 1 NTU at Intake #1 from 2004 to 2019.

Figure 1 2000-2019 Annual Turbidity Average

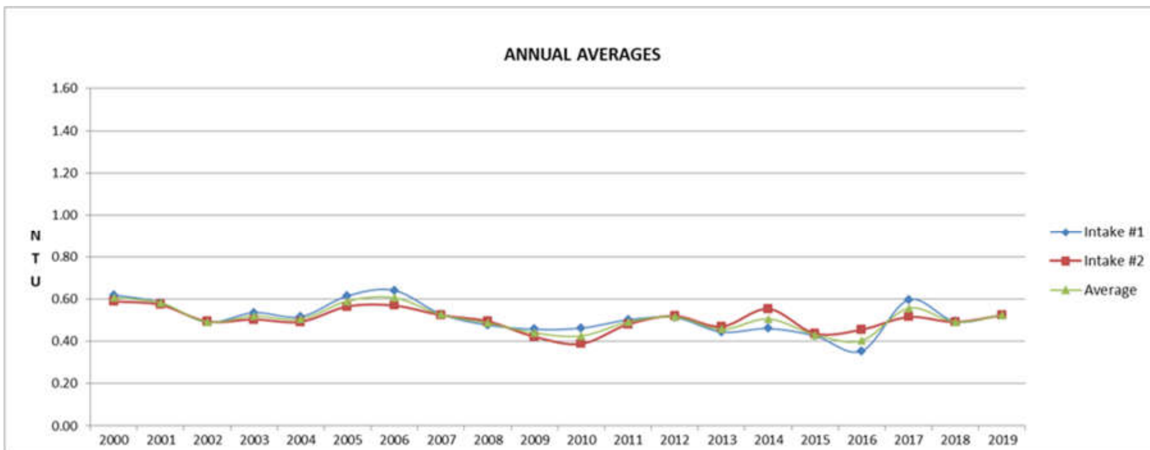


Figure 2 2000-2019 September Annual Turbidity Average

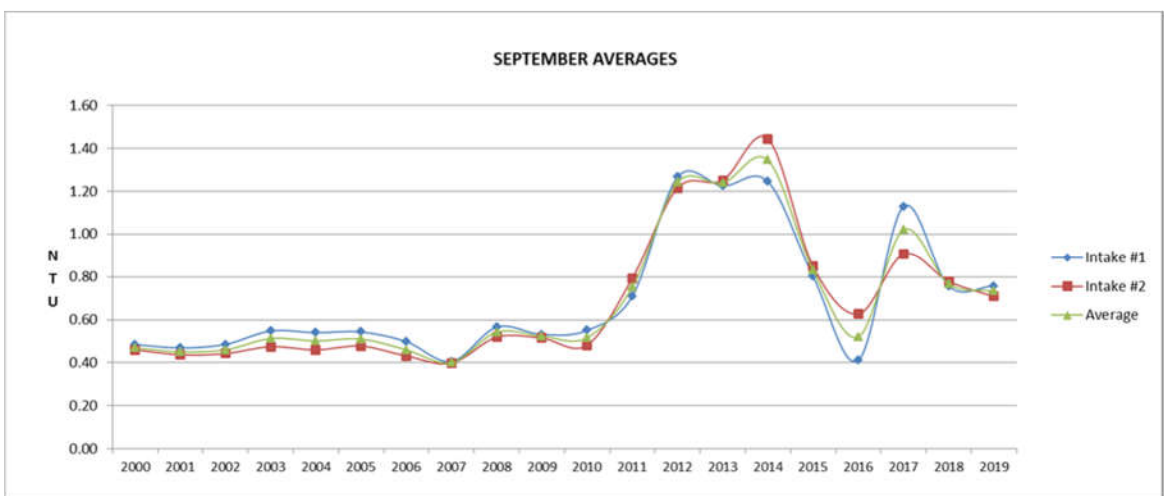


Figure 3 2004-2019 Daily Maximum Turbidity (NTU) Intake #1

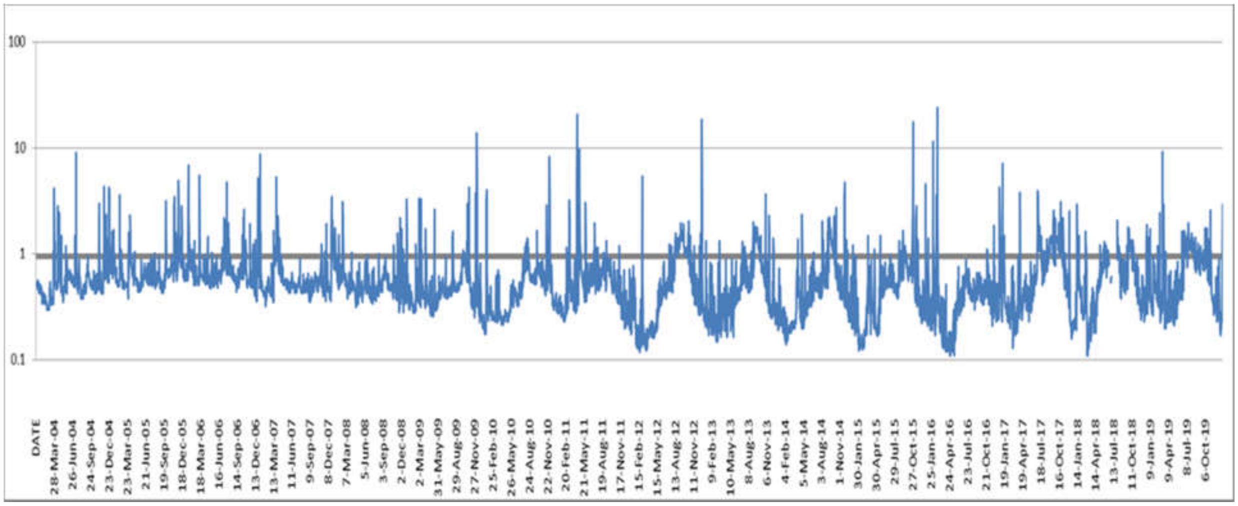


Figure 4 Monthly Counts of Turbidity >1 NTU at Intake 1, 2004-2019

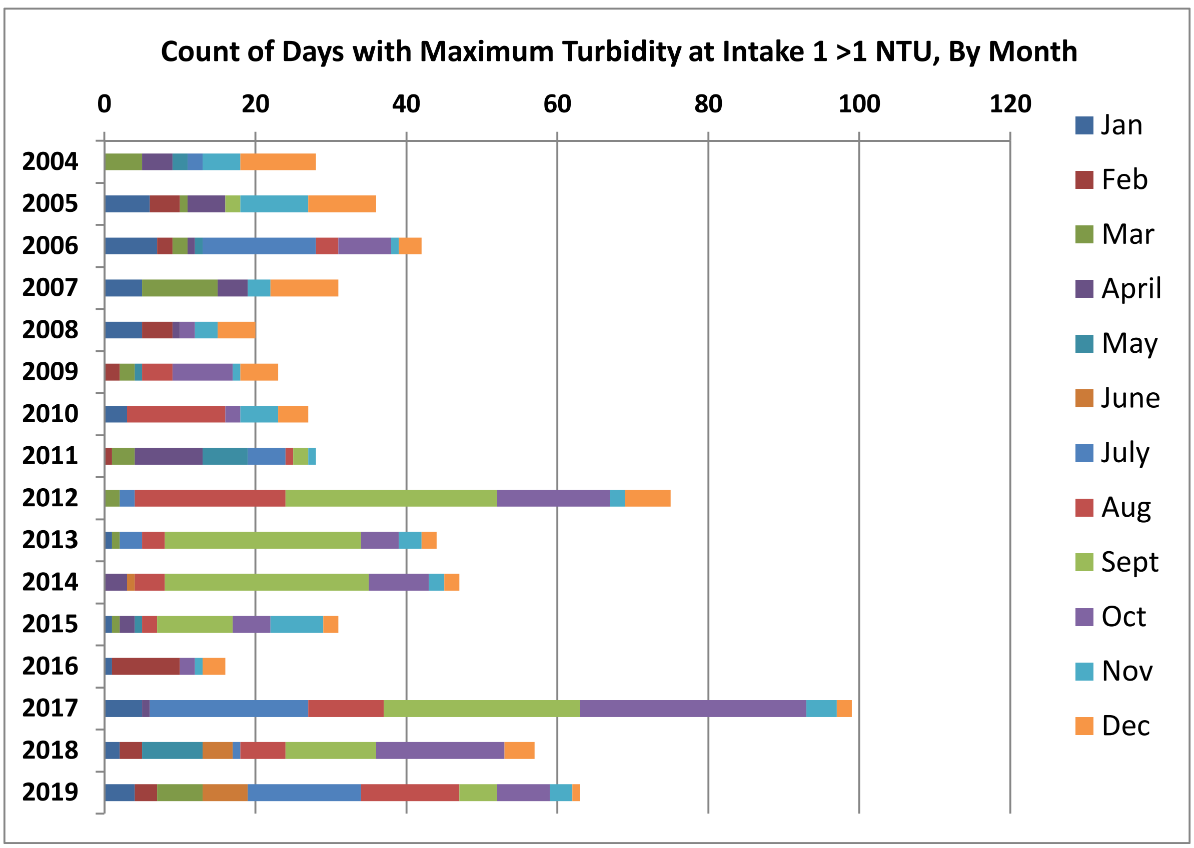


Table 8 Syracuse Water Plant Raw Water Maximum, Minimum, and Average Monthly Turbidity in NTU for 2019 (Both Intake 1 & 2)

Month	Intake 1 Maximum	Intake 1 Minimum	Intake 2 Maximum	Intake 2 Minimum	Intake 1 Average	Intake 2 Average
January	1.71	0.17	4.63	0.20	0.44	0.39
February	2.42	0.17	4.55	0.17	0.41	0.40
March	9.25	0.12	14.21	0.18	0.52	0.51
April	0.68	0.12	1.38	0.13	0.26	0.34
May	0.84	0.17	0.87	0.20	0.29	0.41
June	1.65	0.21	1.21	0.29	0.59	0.62
July	1.95	0.49	1.67	0.19	0.88	0.73
August	1.43	0.46	1.21	0.40	0.84	0.74
September	1.26	0.49	1.12	0.54	0.76	0.71
October	1.76	0.34	1.74	0.31	0.72	0.66
November	2.57	0.23	1.29	0.12	0.38	0.39
December	2.91	0.15	1.71	0.11	0.28	0.28
				Cumulative Average	0.53	0.52

Table 9 Number of Days with Maximum Turbidity > 1 NTU, Intake 1

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Summed by Month
Jan	0	6	7	5	5	0	3	0	0	1	0	1	1	5	2	4	40
Feb	0	4	2	0	4	2	0	1	0	0	0	0	9	0	3	3	28
Mar	5	1	2	10	0	2	0	3	2	1	0	1	0	0		6	33
April	4	5	1	4	1	0	0	9	0	0	3	2	0	1		0	30
May	2	0	1	0	0	1	0	6	0	0	0	1	0	0	8	0	19
June	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	6	11
July	2	0	15	0	0	0	0	5	2	3	0	0	0	21	1	15	64
Aug	0	0	3	0	0	4	13	1	20	3	4	2	0	10	6	13	79
Sept	0	2	0	0	0	0	0	2	28	26	27	10	0	26	12	5	138
Oct	0	0	7	0	2	8	2	0	15	5	8	5	2	30	17	7	108
Nov	5	9	1	3	3	1	5	1	2	3	2	7	1	4		3	50
Dec	10	9	3	9	5	5	4	0	6	2	2	2	3	2	4	1	67
Summed by Year	28	36	42	31	20	23	27	28	75	44	47	31	16	99	57	63	

2.2 Intake Closures

The Intakes may be closed in order to prevent a Treatment Technique Violation (TTV: any day with a turbidity reading exceeding 5 NTU) or Turbidity Event (a series of consecutive days during which at least one turbidity measurement each day exceeds 5 NTU).

Typically, Intake #2 is impacted by high wind events that re-suspend bottom sediments. This causes turbid water to enter the intake. Intake #1 may be impacted by significant runoff resulting from a high precipitation event. The high runoff causes sediment laden storm flows in Shotwell Brook. This brook is a main tributary on the north end of the lake that discharges approximately 1200 feet south of Intake #1. When the wind speeds are high enough and the wind direction is southerly, this plume of highly turbid water discharged into the lake can be transported over the intake. The majority of intake closures are to Intake #2.

Intake #2 was closed on twenty eight occasions in order to prevent a TTV or a Turbidity Event. There was one Intake #1 closure in 2019 related to turbidity concerns (Table No. 10).

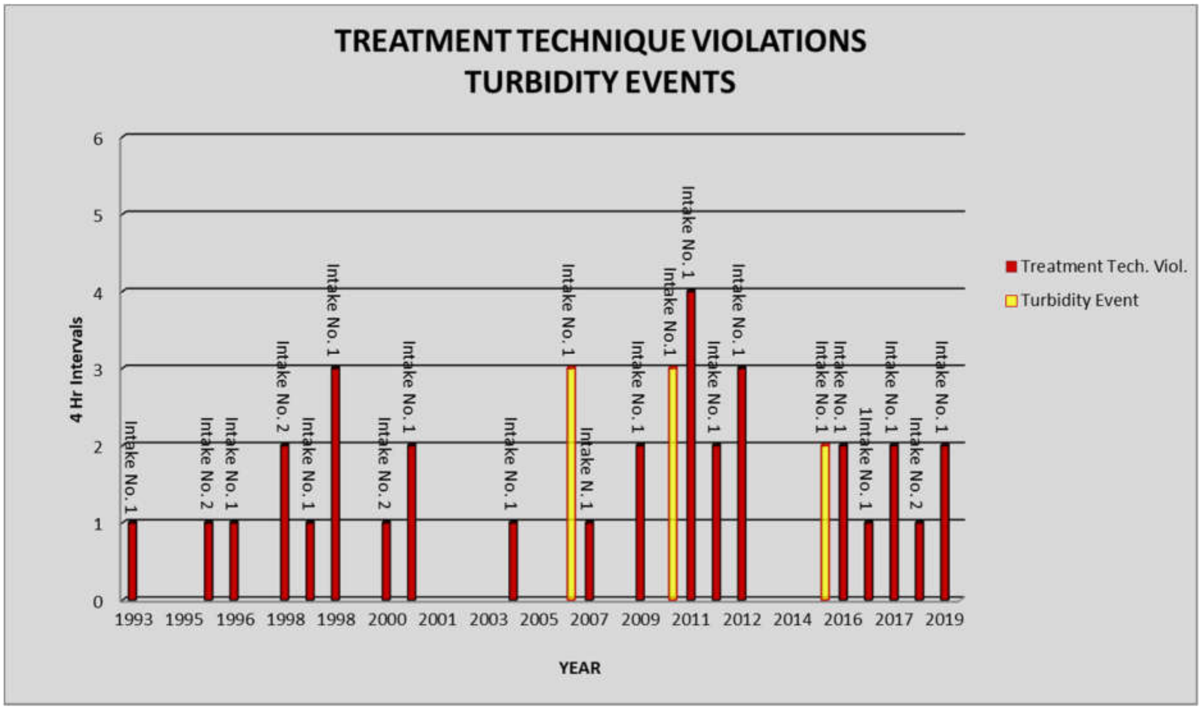
Table 10 Raw Water Intake Closures

Date Intake Closed	Date Intake Opened	Intake Affected	Violation (Yes/No)
1/7/2019	1/10/2019	2	No
1/22/2019	1/24/2019	2	No
1/28/2019	1/30/2019	2	No
2/8/2019	2/9/2019	2	No
2/12/2019	2/13/2019	2	No
2/15/2019	2/16/2019	2	No
2/21/2019	2/22/2019	2	No
2/24/2019	2/26/2019	2	No
3/10/2019	3/12/2019	2	Yes
3/14/2019	3/16/2019	2	No
4/12/2019	4/13/2019	2	No
4/14/2019	4/15/2019	2	No
4/18/2019	4/19/2019	2	No
4/26/2019	4/27/2019	2	No
5/9/2019	5/10/2019	2	No
6/24/2019	6/27/2019	1	No
9/13/2019	9/15/2019	2	No
10/6/2019	10/7/2019	2	No
10/16/2019	10/18/2019	2	No
10/22/2019	10/23/2019	2	No
10/27/2019	10/28/2019	2	No
10/29/2019	10/30/2019	2	No
10/31/2019	11/2/2019	2	No
11/4/2019	11/5/2019	2	No
12/8/2019	12/10/2019	2	No
12/13/2019	12/14/2019	2	No
12/30/2019	12/31/2019	2	No
1/7/2019	1/10/2019	2	No
1/22/2019	1/24/2019	2	No

One TTV was recorded in 2019. The violation occurred on March 10, 2019 on Intake #1 & #2. A turbidity measurement of 14.21 NTU was recorded at 8:00 am on Intake #2. Turbidity exceeded five NTU on Intake #1 at 8:00 am (6.40 NTU) and 12:00 pm (9.25 NTU). Intake #2 was completely closed by 9:15 am on March 10 and re-opened on March 12. Intake #1 was not shut down.

Refer to Figure 5 for TTV and Turbidity Events recorded since 1993. The Graph also displays the frequency that 5.0 NTU was exceeded (on a four hour interval) during the TTV or Turbidity Event. Note that in 2015, a Turbidity Event consisted of only two 5.0 NTU exceedances at four hour intervals, comparable to numerous TTV's illustrated in the graph. However, because the intervals were at 8:00 pm and 12:00 am, the conditions set forth by NYSDOH defining a Turbidity Event (a series of consecutive days during which at least one turbidity measurement each day exceeded 5 NTU) was attained.

Figure 5 1993-2019 Treatment Technique Violations vs Turbidity Events



2.3 Turbidity Analysis at City Reservoirs

Additional turbidity analyses were done Monday-Friday at the Woodland Reservoir and Westcott Reservoir effluent conduits, and four locations within the distribution system. These additional analyses were conducted by Department of Water, Maintenance and Operations Section personnel. Hach 2100N turbidimeters are also located at the Woodland and Westcott Reservoir Gatehouses. The turbidimeters are also calibrated monthly by Water Plant personnel. During 2019 no monthly average turbidity in the distribution system exceeded 5.0 NTU. The results of this monitoring routine are included in the monthly reports sent to the NYSDOH.

2.4 Total and Fecal Coliform Sampling and Analyses

Total coliform and fecal coliform samples were collected at the Water Plant (raw water) five times/week/intake as directed by Title 10, Part 5 of the Official Compilation of Codes, Rules and Regulations of New York (10 NYCRR Part 5). The samples were analyzed by a NYSDOH certified commercial laboratory using the membrane filter (MF) technique. Of the 524 samples collected for total coliform analyses, there were no samples that exceeded 100 coliform forming units (cfu). Note that only the fecal coliform results are used to determine compliance with the City's filtration avoidance. Of the 528 samples collected for fecal coliform analyses, there were no samples that exceeded 20 cfu. No six-month threshold for fecal coliform density was exceeded. Table Nos. 11 and 12 summarize the monthly analyses for total and fecal coliform, for each intake, respectively.

In addition to the sampling conducted at the Water Treatment Plant, samples were routinely collected within the distribution system in Syracuse to insure water quality. Samples were collected at 51 locations within the City. Approximately 195-255 samples were collected per month or 2,587 samples for the year.

Table 11 Skaneateles Lake Raw Water Total Coliform Analyses Rolling Six-month 10% Threshold for Part 5 Violation Criteria

For 6-Month Period Ending	Number of Samples Analyzed	Number of Samples Analyzed	Number of Samples >100 Colonies	Number of Samples >100 Colonies	Percent >100 Colonies	Percent >100 Colonies
Intake:	Number 1	Number 2	Number 1	Number 2	Number 1	Number 2
January	105	133	0	0	0.00%	0.00%
February	107	131	0	0	0.00%	0.00%
March	110	133	0	0	0.00%	0.00%
April	132	132	0	0	0.00%	0.00%
May	133	133	0	0	0.00%	0.00%
June	121	131	0	0	0.00%	0.00%
July	121	131	0	0	0.00%	0.00%
August	132	132	0	0	0.00%	0.00%
September	130	130	0	0	0.00%	0.00%
October	131	131	0	0	0.00%	0.00%
November	131	131	0	0	0.00%	0.00%
December	132	130	0	0	0.00%	0.00%

Table 12 Skaneateles Lake Raw Water Fecal Coliform Analyses Rolling Six-month 10% Threshold for Part 5 Violation Criteria

For 6-Month Period Ending	Number of Samples Analyzed	Number of Samples Analyzed	Number of Samples >20 Colonies	Number of Samples >20 Colonies	Percent >20 Colonies	Percent >20 Colonies
Intake:	Number 1	Number 2	Number 1	Number 2	Number 1	Number 2
January	103	131	0	1	0.00%	0.76%
February	105	129	0	1	0.00%	0.78%
March	108	131	0	1	0.00%	0.76%
April	130	130	0	0	0.00%	0.00%
May	131	131	0	0	0.00%	0.00%
June	133	133	0	0	0.00%	0.00%
July	133	133	0	0	0.00%	0.00%
August	134	134	0	0	0.00%	0.00%
September	132	132	0	0	0.00%	0.00%
October	133	133	0	0	0.00%	0.00%
November	131	131	0	0	0.00%	0.00%
December	132	130	0	0	0.00%	0.00%

2.5 Giardia and Cryptosporidium Sampling and Analyses

Analyses for the presence of Giardia cysts and Cryptosporidium oocysts began in 1985 and 1988, respectively. During 2019, samples were collected monthly from the raw water intakes (Intake #1 and Intake #2). A total of 24 samples were collected for Giardia and Cryptosporidium in 2019. Environmental Protection Agency (EPA) Method 1623 was the analysis utilized.

There were no confirmed Giardia cysts or Cryptosporidium oocysts detected in 2019. Since 1986, there have been 1,205 samples analyzed for Giardia and 1,193 samples for Cryptosporidium. Confirmed Giardia cysts have been observed in ten samples. Of these, eight were samples collected from tributaries within the watershed, one was a sample collected from Raw Water Intake #2 and one was collected from the Water Shop in 2003 (Table No. 13). Cryptosporidium oocysts have been observed on nine occasions since 1988. Of these, three sample locations were tributaries and three were from Raw Water Intake samples (Table No. 14).

Table 13 Skaneateles and Watershed *Giardia* Detection: Incidents of Confirmed Cysts

Incident Number	Date	Location	Cysts Detected	Calculated as Cysts/100 Liters
1	December 11, 1990	Grout Brook	2	2.6
2	March 14, 1991	Intake 2	1	0.1
3	March 14, 1991	Grout Brook	3	1.6
4	June 22, 1992	Shotwell Brook	2	6.6
5	June 22, 1992	One Mile Brook	4	4.2
6	August 28, 1992	Shotwell Brook	1	5.3
7	November 23, 1992	Willow Brook	1	0.3
8	November 23, 1992	Harrold Brook	2	2.1
9	March 24, 1993	Harrold Brook	1	1.1
10	May 13, 2003 *;**	Water Shop	1	2.0

* As of 2000, results are listed as cysts/liter

** As of August 2000, Method 1623 used for analyses

Table 14 Skaneateles and Watershed *Cryptosporidium* Detection: Incidents of Confirmed Oocysts

Incident Number	Date	Location	Oocysts Detected	Calculated as Oocysts/100 Liters
1	July 26, 1988	Intake 1	1	2.1
2	March 15. 1989	Intake 1	1	0.1
3	December 11, 1990	Grout Brook	2	2.6
4	November 23, 1992	Willow Brook	1	0.3
5	November 23, 1992	Harrold Brook	1	1.1
6	September 15, 2004 *;**	Intake 2 ***	2	4.0
7	September 21, 2011	Water Shop	5	0.1
8	October 3, 2011	Water Shop	1	0.02
9	October 3, 2011	Woodland Reservoir	2	0.01

* As of 2000, results are listed as cysts/liter ** As of August 2000, Method 1623 is used for analyses

*** Previous reports list Intake 1 as the affected intake. That was incorrect. The oocysts were in a sample from Intake 2

2.6 Skaneateles Lake Limnological Sampling and Analyses

2.6.1 Algal Analyses

The sampling regime included station samples and depth profile samples. The station sampling consists of collecting one-liter samples at eight locations on the lake at a depth of 20'. The sites are approximately two miles apart. Sampling was conducted on 16 dates with 116 one-liter samples being collected and analyzed for algal content.

It is noted that the Secchi disk readings effected during the station sampling can be somewhat skewed. Since stations I and VIII are shallow, the readings are consistently at the bottom, which is usually about six meters (as a result, samples are collected at about 15 feet). It is not unusual for the readings at the other Stations to vary considerably throughout the spring, summer and fall seasons, ranging from four to 16 meters (Figure 6). Figures 7 and 8 illustrate secchi disk depth variations between early summer and fall. References to Secchi disk readings in the narrative below are adjusted, i.e., only Stations II – VII were used to determine averages.

Depth profile samples were collected at a location approximately four miles from the northern shore in the center of the lake. On each of the six sampling dates, 21 one-liter samples were collected at 10 foot intervals from the surface to a depth of 200 feet. Each was analyzed for temperature and turbidity. Algal content was determined on those samples representing the different layers of stratification: six of the 21 samples collected on each date were analyzed for algal content. Thirty six one-liter samples were analyzed for algal concentration during the season.

Sampling was conducted from May through October 2019. The majority of genera observed were blue-green algae of the Phylum Cyanophyta (genus, Polycystis and Cyanobium) and diatoms of the Phylum Chrysophyta (genus, Cyclotella) (Table No. 15). For Station Samples, three genera accounted for 85.99% of the total cell count; Polycystis (40.68%), Cyclotella (32.24%) and Cyanobium (13.07%). For Depth Profile samples, three genera accounted for 87.77% of the total cell count. Polycystis and Cyclotella were dominant at 36.70%, and 35.32% respectively. Cyanobium accounted for 15.75% of the total.

The station and depth profile sample collection and analyses are discussed in greater detail below. Table No. 16 lists the dates and results of the Station analyses. Table No. 17 is a summary of the Depth Profile analyses.

Note: There have been changes to the identification (or naming) of the various genera over the past several years. For the most part, the changes apply to growth in the city reservoirs. A complete summary can be found in the draft document: City of Syracuse Water Department: Woodland Reservoir Treatment Procedures for Algal Control.

Figure 6 Average Secchi Disk Depths 1987-2019

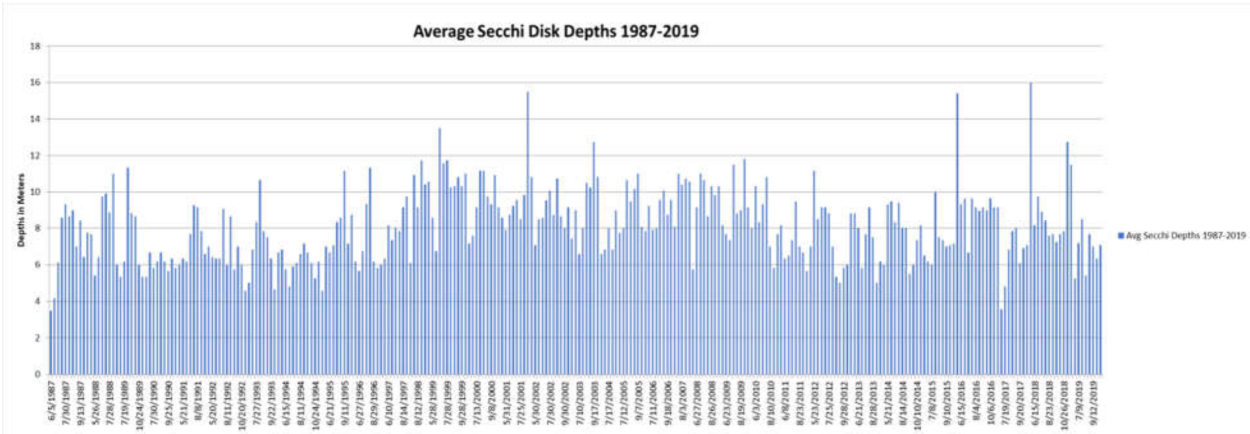


Figure 7 Average Secchi Disk Depths (June) 1987-2019

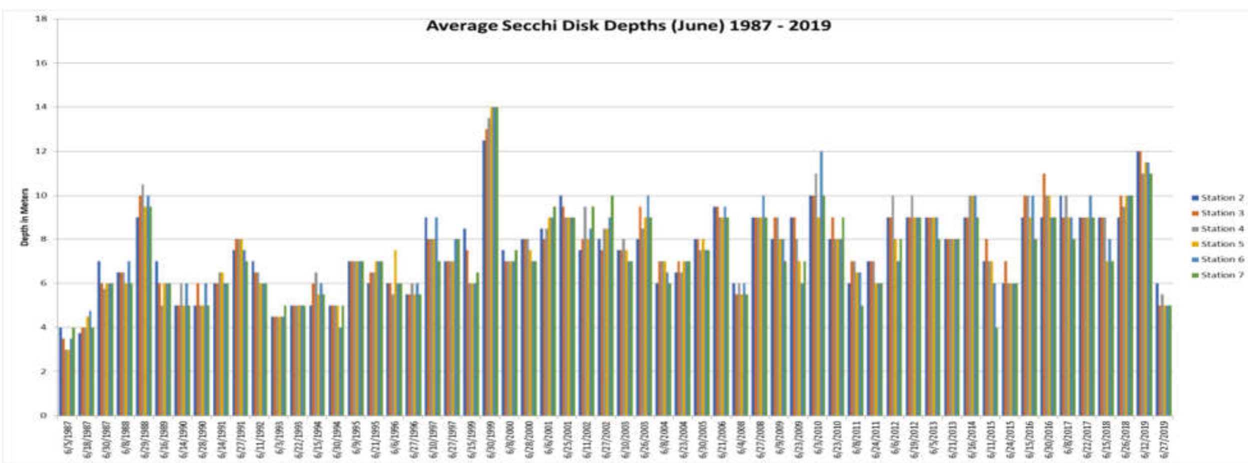


Figure 8 Average Secchi Disk Depths (September) 1987-2019

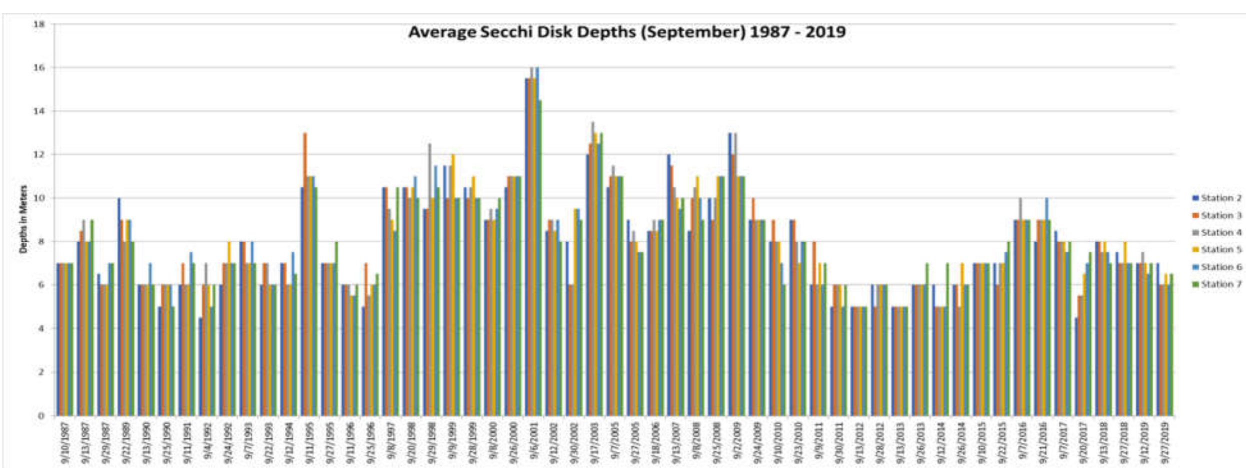


Table 15 Genera of Phytoplankton Typically Found in Skaneateles Lake

Phylum: Chrysophyta (Diatoms)

Achnanthes	Coscinodiscus	Diatoma	Meridion	Pinnularia	Surirella
Asterionella	Cyclotella	Fragellaria	Navicula	Stauroneis	Synedra
Cocconeis	Cymbella	Gomphonema	Nitzschia	Stephanodiscus	Tabellaria

Phylum: Chrysophyta (Golden-Brown)

Centritractus	Tribonema
Dinobryon	Mallomonas

Phylum: Chlorophyta (Green)

Botyrococcus	Cosmarium	Palmella	Straurastrum
Chlorcoccum	Hydrodictyon	Pediastrum	Tetraedron
Chlorella	Nitella	Phytoconis	Ulothrix
Coelastrum	Oocystis	Scenedesmus	Volvox

Phylum: Cyanophyta (Blue-Green)

Anabaena	Cyanarcus	Merismopdia
Aphanothece	Gomphosphaeria	Rivularia
Polycystis	Lyngbya	Oscillatoria
Chroococcus	Cyanobium	

Phylum: Euglenophyta (Flagellates)

Euglena	Trachelomonas

Phylum: Pyrrophyta (Dinoflagellates)

Ceratium	Peridinium

Table 16 Station Sampling Analyses Skaneateles Lake Algal Content 2019

Date	Average Total Cell Count	Dominant Form	Percent of Total	Average Secchi Disk Meters	Average Water Temperature ^{0}F
May 21	881	Polycystis 71.4% Cyanobium 20.8%	92.2%	12.8	46.4
June 12	1121	Cyclotella 55.2% Polycystis 23.1% Polycystis 17.8% Cyanobium 3.7%	96.1%	11.5	56.4
June 27	4131	Polycystis 46.2% Cyclotella 35.9% Cyanobium 15.9%	98.0%	5.3	65.6
July 9	1937	Cyclotella 54.9% Polycystis 32.3% Cyanobium 10.5%	97.7%	7.2	73.9
July 23	1295	Polycystis 43.1% Cyclotella 19.7% Synedra 18.0% Dinobryon 7.8%	88.6%	8.1	75.6
August 9	4432	Polycystis 45.4% Dinobryon 20.0% Synedra 13.0% Cyclotella 8.0%	86.4%	5.4	75.0
August 22	2584	Polycystis 58.3% Cyanobium 16.3% Cyclotella 11.4% Synedra 6.8%	92.8%	7.5	74.3
September 12	2997	Cyclotella 52.6% Polycystis 30.4% Cyanobium 12.4%	95.4%	7.0	69.0
September 27	2413	Cyclotella 48.1% Polycystis 28.5% Cyanobium 19.3%	95.9%	6.3	67.4
October 9	1543	Cyclotella 46.1% Polycystis 25.6% Cyanobium 11.8% Chroococcus Type I 6.3% Chroococcus Type II 6.3%	96.1%	7.1	60.4
Average	2333		93.3%	7.8	66.4

Table 17 Depth Profile Sampling Analyses Skaneateles Lake Algal Content 2019

Date	Average Total Cell Count	Dominant Form	Percent of Total	Average Turbidity	Average Water Temperature ^{0}F
May 29	437	Polycystis 62.3% Cyanobium25.3%	87.6%	0.62	47.4
June 19	1232	Cyclotella 36.9% Polycystis 33.9% Cyanobium 20.4%	91.2%	0.41	52.5
July 18	2196	Cyclotella 55.9% Polycystis 28.2% Cyanobium 8.1%	92.2%	0.51	59.8
August 14	3386	Polycystis 41.1% Cyanobium 20.9% Cyclotella 19.4% Synedra 10.5	91.9%	0.47	57.8
September 18	2235	Cyclotella 48.1% Polycystis 33.9% Cyanobium 10.1%	92.1%	0.47	56.5
October 21	587	Polycystis 36.4% Cyclotella 35.6 % Cyanobium 15.0% Chroococcus Type I 7.2%	94.2%	0.46	52.5
Average	1679		91.5%	0.49	54.4

2.6.2 Station Sample Analysis

Total cell counts for station samples collected on May 21 averaged 881cells/ml. Polycystis was the dominant form accounting for 71.4%, Cyanobium accounted for 20.8%. Secchi disc readings averaged 12.8 meters. Water temperature was exceptionally low for May, averaging 46.40 degrees Fahrenheit.

The total monthly cell count for June averaged 2,626 cells/ml. The June 12 total average cell count was 1,121 cells/ml. Cyclotella was the dominant form, accounting for 55.2% of the total. Polycystis and Cyanobium accounted for 23.1% and 17.8% of the total respectively. The June 27 total cell count average increased significantly from the June 12 sample to 4,131 cells/ml. Polycystis remained dominant at 46.2% of the total, Cyclotella and Cyanobium accounted for 35.9% and 15.9% of the total respectively. Secchi disk readings averaged 11.5 meters on June 12, decreasing significantly to an average of 5.3 meters on June 27. The average water temperature recordings increased from 56.40 degrees Fahrenheit (June 12) to 61.10 degrees Fahrenheit (June 27).

The monthly average total cell count for July was remarkably lower than the June average at 1,616 cells/ml. On July 9, the total average cell count declined to 1,937 cells/ml. Cyclotella accounted for 54.9% of the total count at 8,505 cells/ml. Polycystis and Cyanobium accounted for 32.3% and 10.5% respectively. Water temperatures increased significantly from the June recordings to 73.90 degrees Fahrenheit. The average Secchi disk reading for June 11 was 7.2 meters.

On July 23, the total cell count average decreased to 1,295 cells/ml. Polycystis was the dominant form at all eight stations totaling 43.1% of the total cell count. Cyanobium and Synedra accounted for 19.7% and 18.0% of the cell count respectively. The water temperature increased marginally from the July 9 reading to 75.60 degrees Fahrenheit. Secchi disk readings averaged 7.7 meters.

The August 9 average total cell count was 4,432 cells/ml. The dominant forms were Polycystis (45.4%), Dinobryon (20.3%) and Synedra (13.0%). Polycystis was the dominant form for all eight stations on August 22. Average total cell count decreased to 2,584 cells/ml. Polycystis, counts totaled 12,045 cells/ml. (58.3%). Cyanobium and Cyclotella totaled 3,374 cells/ml. (16.3%) and 2,365 cells/ml. (11.4%) respectively. For the month of August, water temperatures averaged 74.60 degrees Fahrenheit and Secchi disk readings averaged 6.5 meters.

Total cell counts for September 12 and September 27 averaged 2,997 cells/ml. and 2,413 cells/ml. respectively. Dominant form percentages were similar for both sample events, consisting of Cyclotella, Polycystis and Cyanobium. For the September 12 sample event, Cyclotella, comprised over 50% of the total cell count (52.6%). Polycystis and Cyanobium accounted for 30.4% and 12.5% of the total cell count respectively. Cyclotella accounted for 48.1% of the September 29 sample event. Polycystis and Cyanobium accounted for 28.5% and 19.3% respectively. Water temperatures for the month of September averaged 68.20 degrees Fahrenheit. Secchi disk readings averaged 6.6 meters.

Cyclotella, Polycystis and Cyanobium continued to be the dominant forms for the October 9 sample event, accounting for 46.1%, 25.6% and 11.8% of the total cell count respectively. Both Chroococcus Type I and Chroococcus Type II cell counts, which accounted for 1% or significantly less of the total cell count throughout the season, each totaled 6.3%. Water temperatures averaged 60.40 degrees Fahrenheit and Secchi disc readings averaged 7.1 meters.

2.6.3 Depth Profile Sample Analysis

The total cell count for the May 29 depth profile averaged 437 cells/ml. Polycystis was the dominant form throughout the water column, accounting for 62.3% of the total cell count. Cyanobium accounted for 25.3%. Water temperature averaged 47.40 degrees Fahrenheit, ranging from 50.00 degrees Fahrenheit at the surface and gradually declining to 43.00 degrees Fahrenheit at 200 feet. The lake was still exhibiting spring turnover, with weak thermal stratification.

The total cell count for the June 19 depth profile averaged 1,232 cells/ml. Dominant forms included Cyclotella (36.9%) Polycystis (33.9%) and Cyanobium (20.4%). Species richness increased from 18 forms (May 29 sample) to 26 forms. The surface temperature increased dramatically between depth profile sample events (three-week period) from 50.00 degrees Fahrenheit on May 29 to 70.00 degrees Fahrenheit. The epiliminion and metalimnion were not well established. The hypoliminion extended from 120 feet downward.

The total cell count for the July 18 depth profile averaged 2,196 cells/ml. Dominant forms were Cyclotella, Polycystis, and Cynaobium at 55.9%, 28.2% and 8.1% respectively. The water surface temperature was 76.00 degrees Fahrenheit. The epiliminion was shallow, extending to 20 feet, the metalimnion extended to 100 feet and the hypolimnion extended from 100 feet downward.

On August 14, 2019 the depth profile average total cell count was 3,886 cells/ml. The dominant form was Polycystis (41.1% of the total cell count). Cyanobium and Cyclotella accounted for 20.9%, and 19.4% of the total cell count respectively. The epilimion was well defined, extending to 40 feet. The thermocline extended to 110 feet and the hypolimnion from 120 feet downward. The water temperature ranged from 74.00 degrees Fahrenheit (epilimnic zone) to 47.00 degrees Fahrenheit at 200 feet.

The September 18 depth profile average total cell count was 2,235 cells/ml. Cyclotella was the dominant form at 48.1%. Polycystis and Cyanobium accounted for 33.9% and 10.1% of the total cell count respectively. The epilimnion cooled to a range of 67.00 degrees Fahrenheit to 69.00 degrees Fahrenheit and extended to a depth of 50 feet. The metalimnion extended to 130 feet and the hypolimnion from 130 feet downward.

The surface water temperature decreased to 58.00 degrees Fahrenheit for the October 21 depth profile sample event, resulting in a very low average total cell count of 587 cells/ml. Dominant forms were Polycystis and Cyclotella at 36.4% and 35.6% respectively. Cynaobium accounted for 15% of the total cell count. The epilimnion extended deep, to 80 feet. The metalimnion and hypolimnion were not well defined.

3. SKANEATELES LAKE HARMFUL ALGAE BLOOMS (HAB's)

The NYSDEC reported three Confirmed HAB events and five Confirmed HAB events with High Toxins on Skaneateles Lake in 2019. Blooms observed by Skaneateles Lake Watershed Protection staff were generally small, localized and limited to near-shore areas. Monitoring, identifying, sampling and reporting HABs involved a collaborative effort between the NYSDEC Finger Lakes HAB Volunteer Surveillance, NYSDEC Finger Lakes Water Hub, the Skaneateles Lake Association (SLA) Shoreline HABs Program, CSLAP, the City of Syracuse Water Department and water quality measurement stations operated by the USGS and Jefferson Project at Lake George. The SLA Shoreline HABs Program comprised of select volunteers responsible for monitoring 25 zones around the perimeter of Skaneateles Lake. Volunteers report suspicious algal blooms to the HABs Program Coordinator, NYSDEC Division of Water HABsInfo@dec.ny.gov. Water samples collected, were transported to the Syracuse Water Department Treatment Facility in Skaneateles for algal identification. If Microcystis was observed or additional forms of cyanobacteria were identified in significant numbers, samples were transported to an ELAP (Environmental Laboratory Approval Program) certified lab for a FluoroProbe algal "finger printing" and microcystin analysis.

As a result of the numerous volunteers and professional staff monitoring Skaneateles Lake and the heightened awareness of lakefront property owners and watercraft operators, the Lake was intensely monitored and lake conditions assessed in a timely manner. HAB events reported within the Lake's North basin initiated sampling of raw water sample taps for algal identification and dominant forms. Watershed Inspectors also collected surface samples over the water intakes when bloom size and location warranted. The frequent monitoring and the lake-wide surveillance program were instrumental in the early detection of HABs.

3.1 HAB Action Plan for Managing Microcystin in Skaneateles Lake

In coordination with the NYSDOH, a HAB Action Plan was developed in 2018 to ensure that the City's drinking water remained of high quality and microcystin was not detected in treated water above 0.3 µg/L. The Action Plan included short-term and long-term measures, and is updated annually.

3.1.1 Short Term Measures

The short-term measures provided for an aggressive monitoring program. Microcystin sampling at the City's drinking water intakes were initiated on July 1 and extended through October 21. Raw water from both of the City's Intakes was sampled weekly. Samples were collected and transported to an ELAP certified lab on 16 occasions for analysis in 2019. No raw water samples were reported with microcystin levels above the limit of quantitation (LOQ) of 0.3 µg/L (Table No. 18).

Throughout 2017, 2018 and 2019, the City demonstrated that by boosting chlorine levels at the water intake cribs and wet wells and maintaining an elevated chlorine concentration in treated water, microcystin detection was prevented in the water distribution system.

Short term measures also addressed the City's response to finished water microcystin levels above the 0.3 µg/L. in regards to public messaging and agency coordination. These measures included identifying specific agencies and principal contacts involved in decision making and communications and resources immediately available, such as alternate potable water.

Table 18 Skaneateles Lake Microcystin Levels (ug/L) July 1 – October 21, 2019

Date Sampled	7/1	7/8	7/22	7/15	7/29	8/5	8/12	8/19	8/26	9/9	9/16	9/23	9/30	10/7	10/15	10/21
Intake 1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Intake 2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Clear Well 1 & 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clear Well 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skaneateles UV plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elbridge UV plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Westcott incoming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Westcott outgoing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Woodland incoming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wooland outgoing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skaneateles HS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Byrne Dairy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elbridge North	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jordan Town Hall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Syracuse Burnet Ave	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

3.1.2 Long Term Measures

Long term measures include extending the City's shallow water intake. In September 2019, the City's Engineering Consultant submitted a report titled; Conceptual Design of the Extension of Intake No. 2 for review. The document updated key elements of the 2004 Conceptual Design which comprised of extending Intake No. 2 (3,400 feet in length) to a depth of approximately 60 feet. The report included; cost estimations, a preliminary schedule, water quality assessment, hydraulic analysis, pipe design and construction and permitting strategy. Additional measures include developing and/or enhancing interconnections between neighboring public water systems, and continued and advanced source water protection activities. Source water protection activities are also part of the HAB Action Plan that the New York State Department of Environmental Conservation (NYSDEC) is developing in collaboration with steering committees.

3.2 Chemical Sampling and Analyses

Skaneateles Lake water was sampled and analyzed for several chemicals and/or compounds during 2019. The analyses included: trihalomethanes (THM), haloacetic acids (HAA5), volatile organic compounds (VOC) with methyl-tertiary butyl ether (MTBE), synthetic organic compounds (SOC), inorganic chemicals and physical characteristics.

The monitoring results are listed in Tables Nos. 19-27, respectively. The frequency of sampling and methods of analyses were in accordance with 10 NYCRR Part 5-1 and/or Environmental Protection Agency (EPA) regulations. The results of the chemical analyses show that all concentrations were below the New York State Department of Health (NYS DOH) or EPA Maximum Contaminant Levels (MCLs).

Table 19 Total Trihalomethane Analyses of Chlorinated Skaneateles Lake Water for 2019

Results in ug/L	400 East Genesee St.	Serpicos Diner	Functional Comm. Corp.	McChesney Center	Quarterly Average (All Sites)
January 28	22.00	20.40	26.30	21.80	22.63
April 18	25.90	20.14	24.53	20.50	22.77
July 7	47.30	48.10	49.50	41.71	46.65
October 26	38.80	42.90	38.70	35.60	39.00
Locational Annual Average	33.50	32.89	34.76	29.90	

40/30 Certification Exemption per Disinfection Byproducts Rules: <40 ug/L

Table 20 Haloacetic Acids (5) Analyses of Skaneateles Lake Water for 2019

Results in ug/L	400 East Genesee St.	Serpicos Diner	Functional Comm. Corp.	McChesney Center	Quarterly Average (All Sites)
January 28	26.65	28.98	27.31	35.22	29.54
April 18	25.41	18.76	24.31	19.90	22.10
July 7	20.40	26.10	21.60	21.60	22.43
October 26	17.40	21.10	12.60	18.70	17.45
Locational Annual Average	22.47	23.74	21.46	23.86	

Table 21 Volatile Organic Compounds, Vinyl Chloride and MTBE: January 28, 2019 Skaneateles Lake Water

Volatile Organic Compound	ug/L	Volatile Organic Compound	ug/L
Benzene	<0.5	Cis-1,3-Dichloropropene	<0.5
Bromobenzene	<0.5	trans-1,3-Dichloropropene	<0.5
Bromochloromethane	<0.5	Ethylbenzene	<0.5
Bromomethane	<0.5	Hexachlorobutadiene	<0.5
N-Butylbenzene	<0.5	Isopropylbenzene	<0.5
sec-Butylbenzene	<0.5	4-Isopropyltoluene	<0.5
tert-Butylbenzene	<0.5	Methylene Chloride	<0.5
Carbon Tetrachloride	<0.5	n-Propylbenzene	<0.5
Chlorobenzene	<0.5	Styrene	<0.5
Chloroethane	<0.5	1,1,1,2-Tetrachloroethane	<0.5
Chloromethane	<0.5	1,1,2,2-Tetrachloroethane	<0.5
2-Chlorotoluene	<0.5	Tetrachloroethene	<0.5
4-Chlorotoluene	<0.5	Toluene	<0.5
Dibromomethane	<0.5	1,2,3-Trichlorobenzene	<0.5
1,2-Dichlorobenzene	<0.5	1,2,4-Trichlorobenzene	<0.5
1,,3-Dichlorobenzene	<0.5	1,1,1-Trichloroethane	<0.5
1,4-Dichlorobenzene	<0.5	1,1,2-Trichloroethane	<0.5
Dichlorodifluoromethane	<0.5	Trichloroethene	<0.5
1,1-Dichloroethane	<0.5	Trichlorofluoromethane	<0.5
1,2-Dichloroethane	<0.5	1,2,3-Trichloropropane	<0.5
1,1-Dichloroethene	<0.5	1,2,4-Trimethylbenzene	<0.5
cis-1,2-Dichloroethene	<0.5	1,3,5-Trimethylbenzene	<0.5
trans-1,2-Dichloroethene	<0.5	m-Xylene	<0.5
1,2-Dichloropropane	<0.5	o-Xylene	<0.5
1,3-Dichloropropane	<0.5	p-Xylene	<0.5
2,2-Dichloropropane	<0.5	Vinyl Chloride	<0.5
1,1-Dichloropropene	<0.5	MTBE	<0.5

Table 22 Volatile Organic Compounds, Vinyl Chloride and MTBE: April 18, 2019 Skaneateles Lake Water

Volatile Organic Compound	ug/L	Volatile Organic Compound	ug/L
Benzene	<0.5	Cis-1,3-Dichloropropene	<0.5
Bromobenzene	<0.5	trans-1,3-Dichloropropene	<0.5
Bromochloromethane	<0.5	Ethylbenzene	<0.5
Bromomethane	<0.5	Hexachlorobutadiene	<0.5
N-Butylbenzene	<0.5	Isopropylbenzene	<0.5
sec-Butylbenzene	<0.5	4-Isopropyltoluene	<0.5
tert-Butylbenzene	<0.5	Methylene Chloride	<0.5
Carbon Tetrachloride	<0.5	n-Propylbenzene	<0.5
Chlorobenzene	<0.5	Styrene	<0.5
Chloroethane	<0.5	1,1,1,2-Tetrachloroethane	<0.5
Chloromethane	<0.5	1,1,2,2-Tetrachloroethane	<0.5
2-Chlorotoluene	<0.5	Tetrachloroethene	<0.5
4-Chlorotoluene	<0.5	Toluene	<0.5
Dibromomethane	<0.5	1,2,3-Trichlorobenzene	<0.5
1,2-Dichlorobenzene	<0.5	1,2,4-Trichlorobenzene	<0.5
1,,3-Dichlorobenzene	<0.5	1,1,1-Trichloroethane	<0.5
1,4-Dichlorobenzene	<0.5	1,1,2-Trichloroethane	<0.5
Dichlorodifluoromethane	<0.5	Trichloroethene	<0.5
1,1-Dichloroethane	<0.5	Trichlorofluoromethane	<0.5
1,2-Dichloroethane	<0.5	1,2,3-Trichloropropane	<0.5
1,1-Dichloroethene	<0.5	1,2,4-Trimethylbenzene	<0.5
cis-1,2-Dichloroethene	<0.5	1,3,5-Trimethylbenzene	<0.5
trans-1,2-Dichloroethene	<0.5	m-Xylene	<0.5
1,2-Dichloropropane	<0.5	o-Xylene	<0.5
1,3-Dichloropropane	<0.5	p-Xylene	<0.5
2,2-Dichloropropane	<0.5	Vinyl Chloride	<0.5
1,1-Dichloropropene	<0.5	MTBE	<0.5

Table 23 Volatile Organic Compounds, Vinyl Chloride and MTBE: October 16, 2019 Skaneateles Lake Water

Volatile Organic Compound	ug/L	Volatile Organic Compound	ug/L
Benzene	<0.5	Cis-1,3-Dichloropropene	<0.5
Bromobenzene	<0.5	trans-1,3-Dichloropropene	<0.5
Bromochloromethane	<0.5	Ethylbenzene	<0.5
Bromomethane	<0.5	Hexachlorobutadiene	<0.5
N-Butylbenzene	<0.5	Isopropylbenzene	<0.5
sec-Butylbenzene	<0.5	4-Isopropyltoluene	<0.5
tert-Butylbenzene	<0.5	Methylene Chloride	<0.5
Carbon Tetrachloride	<0.5	n-Propylbenzene	<0.5
Chlorobenzene	<0.5	Styrene	<0.5
Chloroethane	<0.5	1,1,1,2-Tetrachloroethane	<0.5
Chloromethane	<0.5	1,1,2,2-Tetrachloroethane	<0.5
2-Chlorotoluene	<0.5	Tetrachloroethene	<0.5
4-Chlorotoluene	<0.5	Toluene	<0.5
Dibromomethane	<0.5	1,2,3-Trichlorobenzene	<0.5
1,2-Dichlorobenzene	<0.5	1,2,4-Trichlorobenzene	<0.5
1,,3-Dichlorobenzene	<0.5	1,1,1-Trichloroethane	<0.5
1,4-Dichlorobenzene	<0.5	1,1,2-Trichloroethane	<0.5
Dichlorodifluoromethane	<0.5	Trichloroethene	<0.5
1,1-Dichloroethane	<0.5	Trichlorofluoromethane	<0.5
1,2-Dichloroethane	<0.5	1,2,3-Trichloropropane	<0.5
1,1-Dichloroethene	<0.5	1,2,4-Trimethylbenzene	<0.5
cis-1,2-Dichloroethene	<0.5	1,3,5-Trimethylbenzene	<0.5
trans-1,2-Dichloroethene	<0.5	m-Xylene	<0.5
1,2-Dichloropropane	<0.5	o-Xylene	<0.5
1,3-Dichloropropane	<0.5	p-Xylene	<0.5
2,2-Dichloropropane	<0.5	Vinyl Chloride	<0.5
1,1-Dichloropropene	<0.5	MTBE	<0.5

Table 24 Volatile Organic Compounds, Vinyl Chloride and MTBE: October 16, 2019 Skaneateles Lake Water

Volatile Organic Compound	ug/L	Volatile Organic Compound	ug/L
Benzene	<0.5	Cis-1,3-Dichloropropene	<0.5
Bromobenzene	<0.5	trans-1,3-Dichloropropene	<0.5
Bromochloromethane	<0.5	Ethylbenzene	<0.5
Bromomethane	<0.5	Hexachlorobutadiene	<0.5
N-Butylbenzene	<0.5	Isopropylbenzene	<0.5
sec-Butylbenzene	<0.5	4-Isopropyltoluene	<0.5
tert-Butylbenzene	<0.5	Methylene Chloride	<0.5
Carbon Tetrachloride	<0.5	n-Propylbenzene	<0.5
Chlorobenzene	<0.5	Styrene	<0.5
Chloroethane	<0.5	1,1,1,2-Tetrachloroethane	<0.5
Chloromethane	<0.5	1,1,2,2-Tetrachloroethane	<0.5
2-Chlorotoluene	<0.5	Tetrachloroethene	<0.5
4-Chlorotoluene	<0.5	Toluene	<0.5
Dibromomethane	<0.5	1,2,3-Trichlorobenzene	<0.5
1,2-Dichlorobenzene	<0.5	1,2,4-Trichlorobenzene	<0.5
1,,3-Dichlorobenzene	<0.5	1,1,1-Trichloroethane	<0.5
1,4-Dichlorobenzene	<0.5	1,1,2-Trichloroethane	<0.5
Dichlorodifluoromethane	<0.5	Trichloroethene	<0.5
1,1-Dichloroethane	<0.5	Trichlorofluoromethane	<0.5
1,2-Dichloroethane	<0.5	1,2,3-Trichloropropane	<0.5
1,1-Dichloroethene	<0.5	1,2,4-Trimethylbenzene	<0.5
cis-1,2-Dichloroethene	<0.5	1,3,5-Trimethylbenzene	<0.5
trans-1,2-Dichloroethene	<0.5	m-Xylene	<0.5
1,2-Dichloropropane	<0.5	o-Xylene	<0.5
1,3-Dichloropropane	<0.5	p-Xylene	<0.5
2,2-Dichloropropane	<0.5	Vinyl Chloride	<0.5
1,1-Dichloropropene	<0.5	MTBE	<0.5

Table 25 Synthetic Organic Compound Analyses of Skaneateles Lake Water July 17, 2019

Part 5 Group Number	Parameter	EPA Standard in ug/L	Results in ug/L
1	Alachlor	0.2	Not Detected
1	Aldicarb	3	Not Detected
1	Aldicarb sulfone	2	Not Detected
1	Aldicarb sulfoxide	4	Not Detected
1	Atrazine	3	Not Detected
2	Benzo(a)pyrene	0.2	Not Detected
1	Carbofuran	40	Not Detected
1	Chlordane, Total	2	Not Detected
2	Bis(2-ethylhexyl)pthalate	6	Not Detected
1	1,2-dibromo-3-chlorpropane	0.2	Not Detected
1	2,4-D	50	Not Detected
2	Dinoseb	7	Not Detected
1	Endrin	2	Not Detected
1	1,2-dibromoethane (EDB)	0.05	Not Detected
1	Heptachlor	0.4	Not Detected
1	Heptachlor expoxide	0.2	Not Detected
2	Hexachlorobenzene	1	Not Detected
1	Gamma-BHC (Lindane)	0.2	Not Detected
+1	Methoxychlor	40	Not Detected
1	Pentachlorophenol	1	Not Detected
1	PCB, Total	0.5	Not Detected
2	Simazine	4	Not Detected
1	Toxaphene	3	Not Detected
1	2,4,5-TP Silvex	10	Not Detected
2	3-Hydroxy Carbofuran	5	Not Detected
2	Aldrin	5	Not Detected
2	Bis(2-ethylhexyl)adipate	50	Not Detected
2	Butachlor	50	Not Detected
2	Carbaryl	5	Not Detected
2	Dalapon	50	Not Detected
2	Dicamba	50	Not Detected
2	Dieldrin	5	Not Detected
2	Glyphosate	50	Not Detected
2	Hexachlorocyclopentadiene	5	Not Detected
2	Methomyl	5	Not Detected
2	Metolachlor	50	Not Detected
2	Metribuzin	50	Not Detected
2	Oxamyl	5	Not Detected

Table 26 Inorganic Chemicals and Physical Characteristics Analysis of Skaneateles Lake Water December 11, 2019

Parameter	EPA Standard in mg/L	Results in mg/L
Antimony	0.006	Not Detected
Arsenic	0.010	Not Detected
Barium	2.0	0.024
Berylium	0.004	Not Detected
Cadmium	0.005	Not Detected
Chromium	0.10	Not Detected
Cyanide	0.02	Not Detected
Mercury	0.002	Not Detected
Nickel	None	Not Detected
Selenium	0.05	Not Detected
Thallium	0.002	Not Detected
Fluoride	2.2	0.77
Chloride	250	21.8
Iron	0.30	Not Detected
Manganese	0.30	0.0008 *
Silver	0.10	Not Detected
Sodium	None	11.7
Sulfate	250	11.6
Color	15 units	<5
Odor	3 units	1
Nitrate	10.0	0.31 **
Nitrite	1.0	Not Detected **

* Sample collected April 18, 2019
**Sample collected October 16, 2019

Table 27 Radionuclide Analyses of Skaneateles Lake Water for 2017 May 10, 2017

Parameter	EPA Standard in picocuries/liter (pCi/l)	Results in pCi/l
Gross Alpha Particle	15	Undetected
Radium 226	5	Undetected
Radium 228	5	Undetected

4. SKANEATELES LAKE WATERSHED PROTECTION PROGRAM

4.1 Watershed Inspection Program Overview

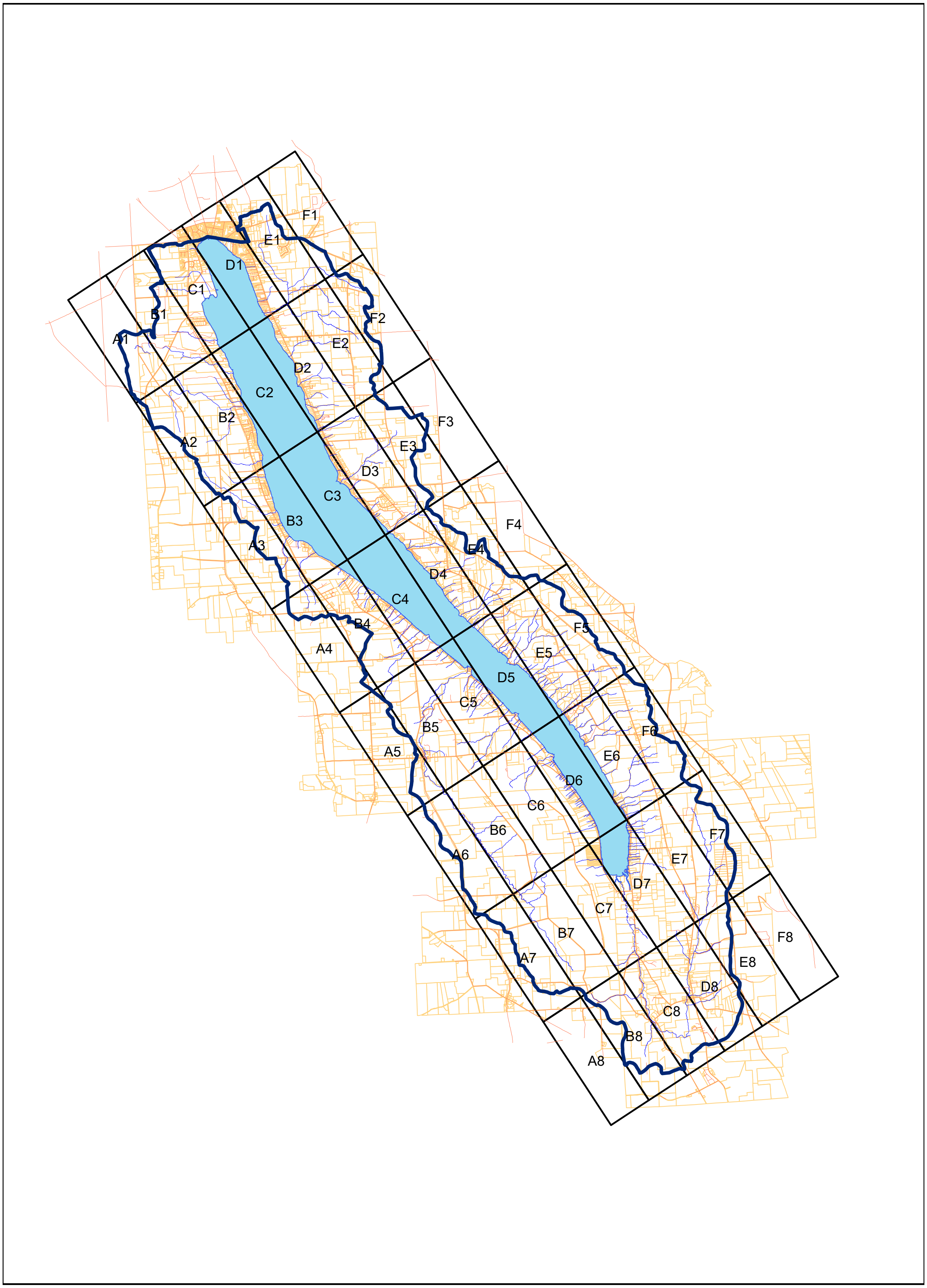
The Watershed Protection Program operated by the City of Syracuse consisted of (a) an Inspection Program to detect violations of the Watershed Rules and Regulations, NYSDOH and county Sanitary Codes, NYS Department of Environmental Conservation (DEC) Environmental Conservation Law (ECL), Navigation Law and local rules and regulations, (b) direct involvement in the procedures for installation of new and repair of existing OWTS, (c) reviewing all design and site plans for proposed building and land disturbing activity and (d) the OWTS Inspection and Dye Testing Program.

Three full-time City of Syracuse personnel routinely patrol the lake and watershed: two Watershed Inspectors 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.

In order 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. In an effort 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 9). 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.

Figure 9 Skaneateles Lake Watershed Inspection Zones



4.2 Onsite Wastewater Treatment System Review and Inspection

Soil tests were witnessed by the Inspectors on 40 occasions in 2019. All soil tests were done in accordance with 10 NYCRR Part 75 (Appendix 75-A) and witnessed by the inspection team. 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 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 30 OWTS design proposals for new construction or alternative engineering design were recommended for approval. Watershed personnel also conducted backfill inspections on repairs, as well as assisted county Sanitarians and design engineers with final inspections for new construction.

4.3 Housing Starts in the Watershed

A total of 11 building permits were issued for new dwellings during 2019 (Table No. 28). Ten of the permits were in Onondaga County. Five were in the Town of Skaneateles (two lakefront), one was in the Village of Skaneateles (not lakefront) and four were issued in the town of Spafford (three lakefront). One permit was issued in the Town of Niles, Cayuga County (not lakefront). No permits were issued in the town of Sempronius (Cayuga County) or Scott, (Cortland County).

Table 28 Construction Activity in the Skaneateles Watershed for 2019

Township	New Construction	Lakefront*	Additions & Renovations	Lakefront**
Village of Skaneateles	1	0	2	0
Town of Skaneateles	5	2	10	6
Spafford	4	3	6	5
Niles	1	0	2	0
Sempronius	0	0	0	0
Scott	0	0	0	0
Total	11	5	20	11

* Included in new construction figures

** Included in additions & renovations figures

4.4 Building Permit Application Review

The Watershed Protection Program reviewed a total 56 Building and Zoning Permit Applications in 2019. As discussed above, 11 were new housing starts. Twenty applications were additions or renovations to existing dwellings and the remaining 25 applications included shoreline structures, accessory structures, landscape features or proposed subdivisions and lot line relocations. Figures 10 through 14 illustrate new construction and renovation proposals reviewed by the City of Syracuse and monitored throughout project duration in the Skaneateles Lake Watershed since 1993.

Figure 10 New Construction Activity within the Skaneateles Lake Watershed 1993-2019

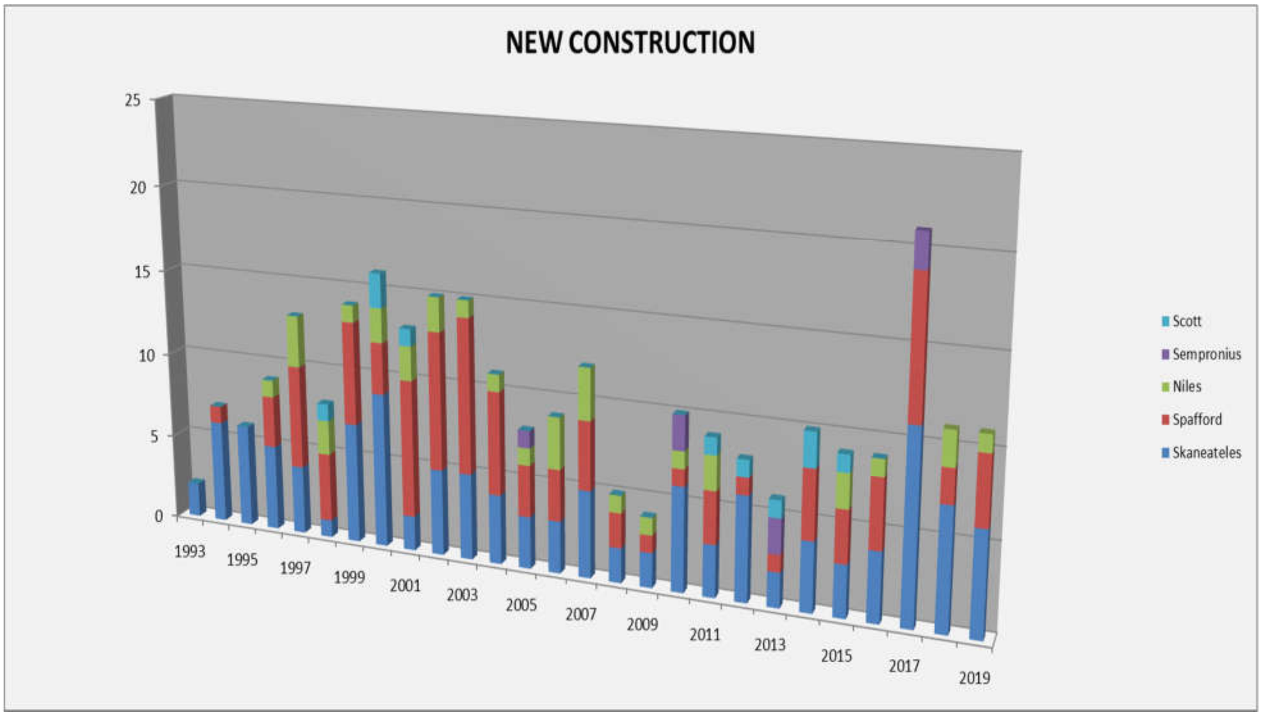


Figure 11 Renovation Activity within the Skaneateles Lake Watershed 1993-2019

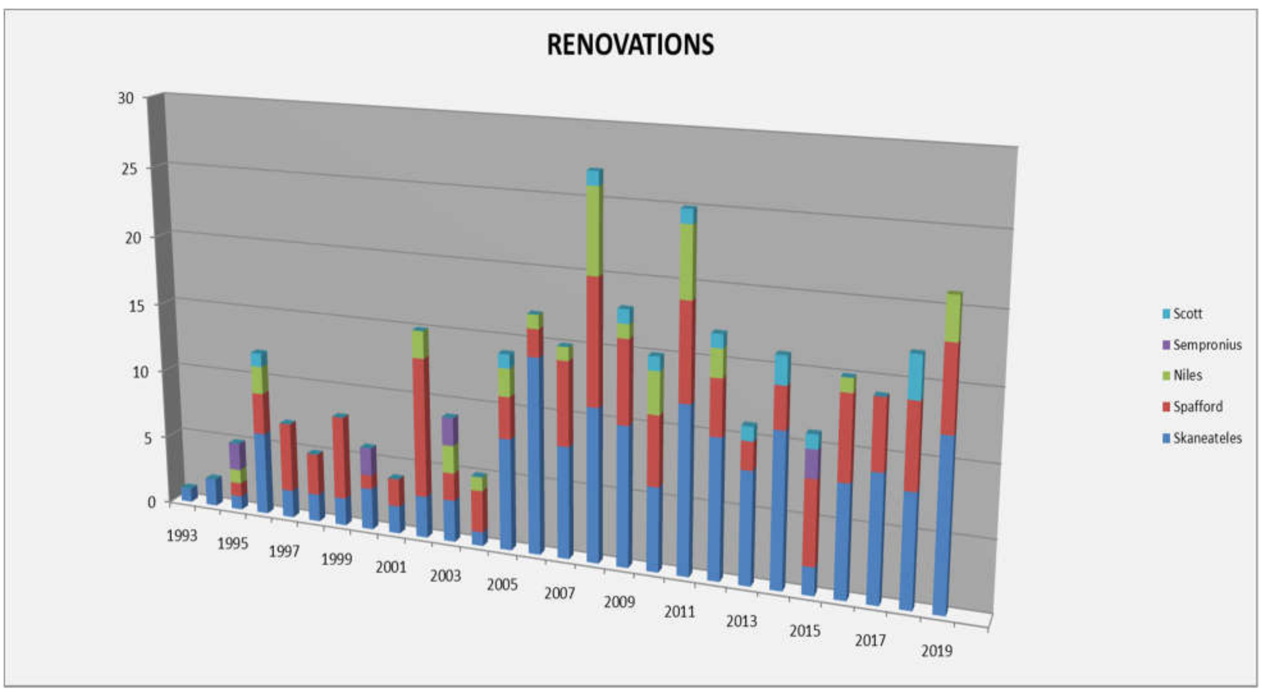


Figure 12 Map of New Construction Activity within the Skaneateles Lake Watershed 1993-2019

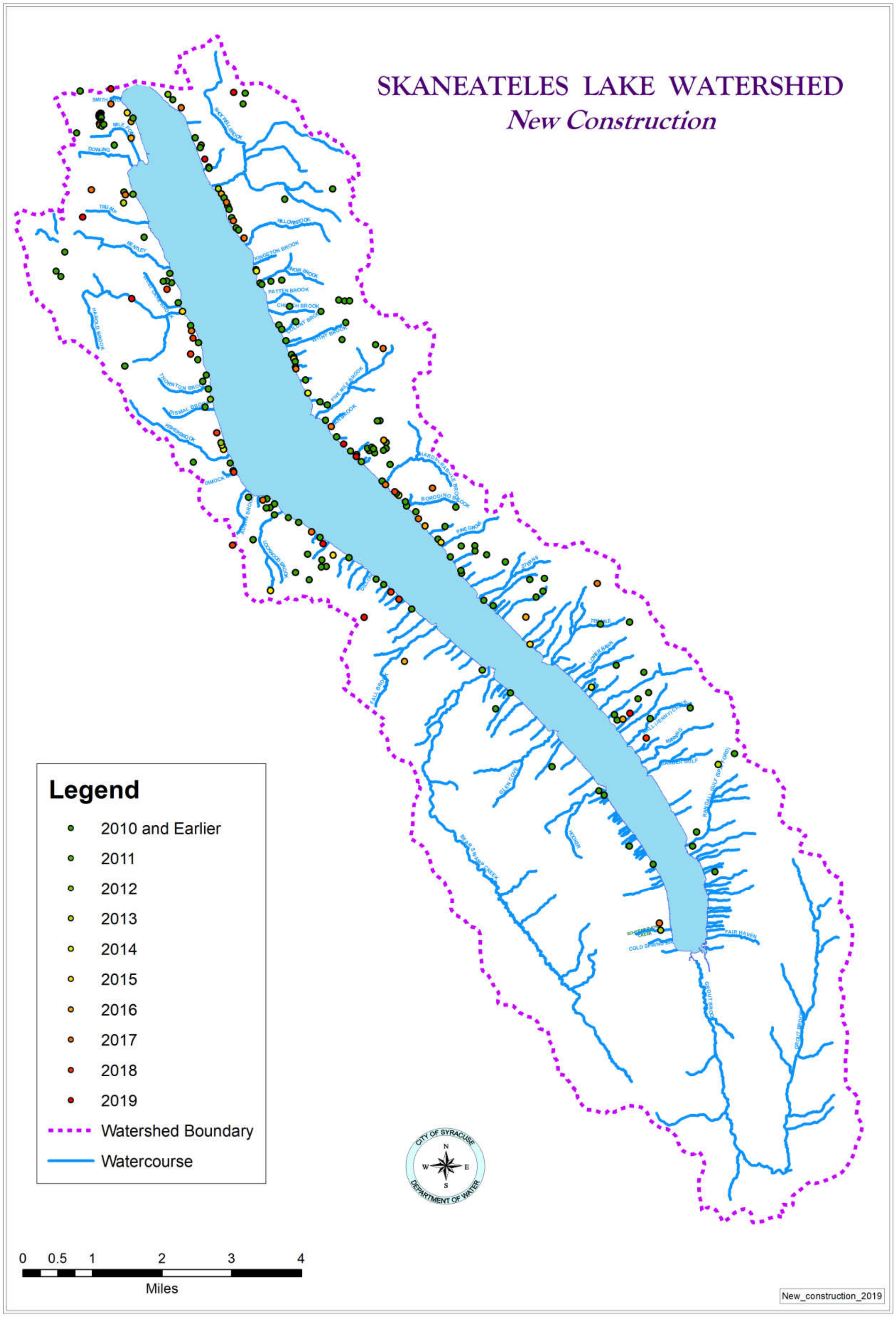
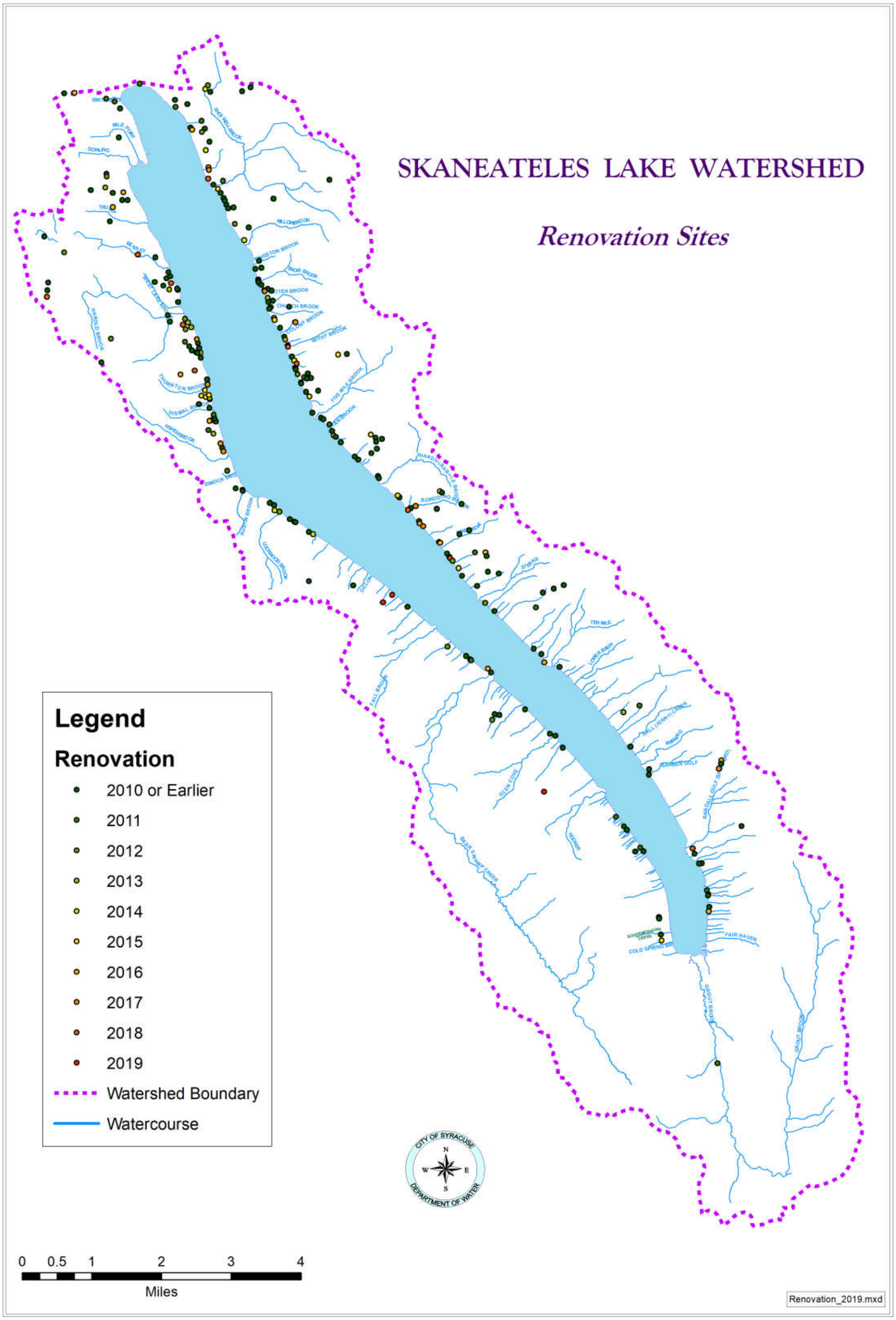


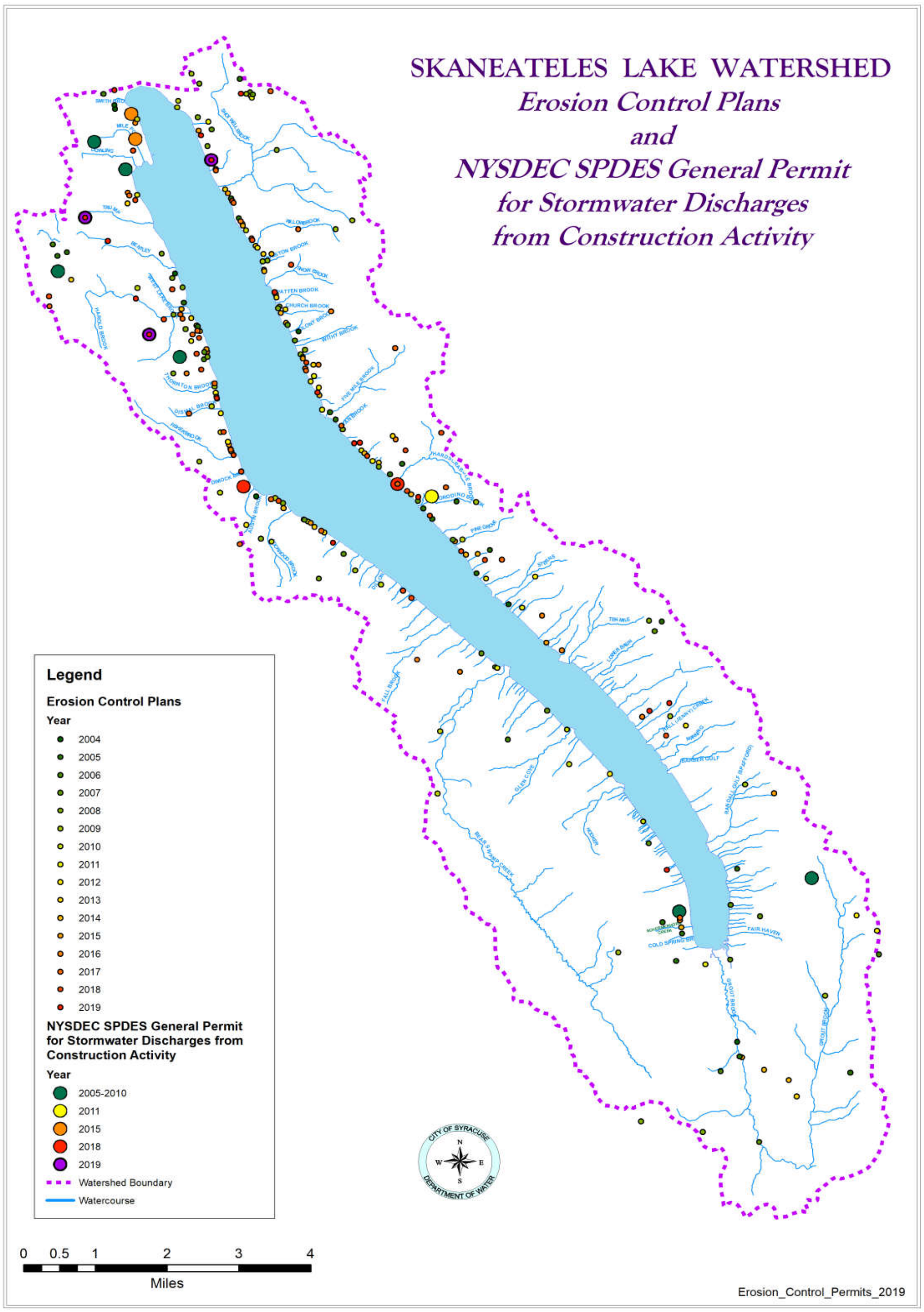
Figure 13 Map of Renovation Activity within the Skaneateles Lake Watershed 1993-2019



4.5 Erosion and Sediment Control Plan Review

As of 2004, the Skaneateles 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. In 2019, 23 SECPs were reviewed. A NYSDEC SPDES General Permit for Storm water Discharges (GP-0-15-002) is required in New York State for all construction activity over one acre. Three permits were issued for construction activity in the Watershed in 2019 under GP-0-15-002. Figure 14 illustrates SECP's reviewed and SPDES General Permits issued within the Skaneateles Lake Watershed since 2004.

Figure 14 Erosion Control Plans/NYSDEC SPDES Permits



4.6 Skaneateles Lake Watershed Rules and Regulations Violations

A total of 24 violations of the Skaneateles Lake Watershed Rules and Regulations were recorded in 2019. The violations are discussed in detail below.

4.6.1 County Sanitary Code Violations

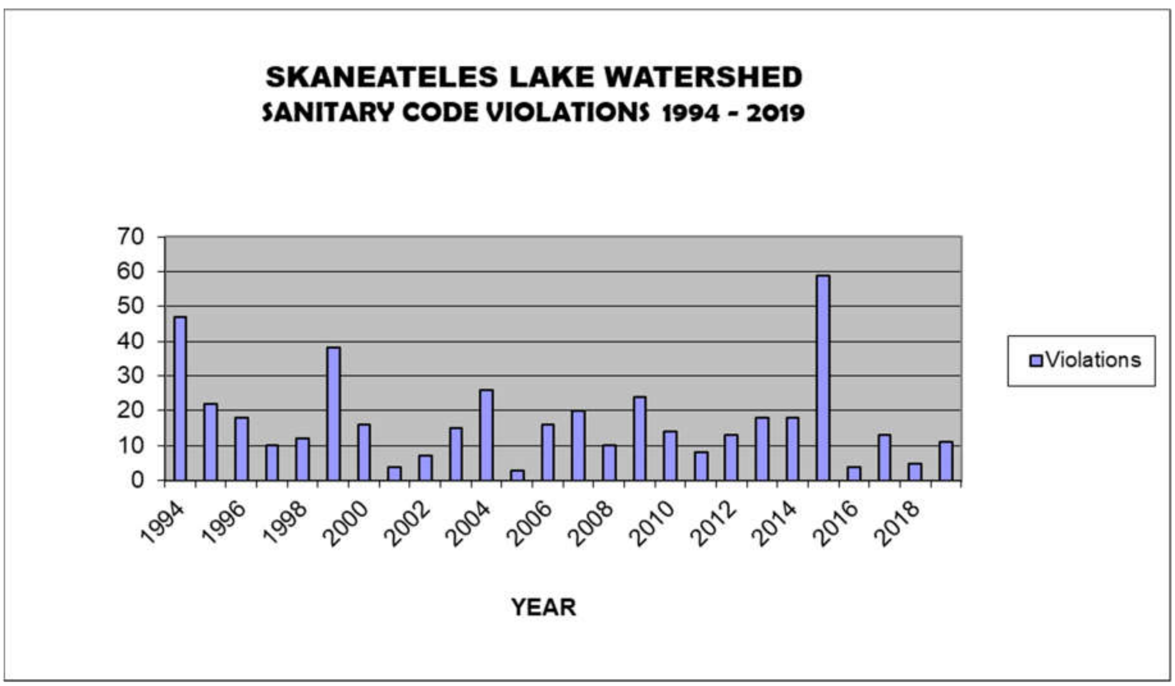
Eleven violations of County Sanitary Code were reported in 2019. Nine violations were the result of failing OWTS. One property owner was cited for failure to renew an operation and maintenance contract for an Enhanced Treatment Unit (ETU). One violation was for an outdoor shower that discharged directly to the ground surface (Table No. 29 at end of next section).

- Seven Sanitary Code violations were abated in 2019.
- Six violations involving failing OWTS were abated as a result of scheduled maintenance, replacement of failing septic system components or complete OWTS replacement.
- One violation was abated through the renewal of an expired O&M contract with a certified ETU service provider.

The abatement process has been initiated for three violations through the Skaneateles Lake Watershed Protection Program and one violation was forwarded to the Onondaga County Department of Health for compliance.

The enforcement of Sanitary Code violations is the responsibility of the respective County health departments. Alleged violators are issued a Violation Notice from the City of Syracuse and given five working days to reply and declare their intent to affect the necessary repairs. If there is no response, or if the property owner refuses to abate the problem, the violation is forwarded to the respective county health department for enforcement. Sanitary Code violations identified by Watershed Inspectors since 1993 are shown in Figure 15.

Figure 15 Skaneateles Lake Watershed Sanitary Code Violations 1994-2019



4.6.2 Erosion and Sediment Control Violations

Thirteen violations were issued for non-compliance of sediment and erosion control practices in 2019. Twelve of the violations were abated in 2019. One violation will be addressed when site conditions allow. (Table No. 29).

Table 29 Violations for the Past Five Years: NYSDOH and Local DOH Sanitary Code Erosion and Sediment Control

Year	Number or Violations DOH/Sanitary Code	Number or Violations Erosion and Sediment	Abated or Pending Action by City	Reported to DOH or NYSDEC
2015	59	5	62	2
2016	4	6	9	1
2017	13	17	30	0
2018	5	14	18	1
2019	11	13	23	1

* New regulations became effective in 2004

4.6.3 Petroleum/Hazardous Material Spills

There were nine potentially hazardous material releases or spills identified by City personnel or reported by NYSDEC Division of Environmental Remediation in 2019.

- **January 11, 2019** - resulting from a tractor trailer accident on East Lake Road, in the town of Skaneateles. Approximately five gallons of diesel fuel was released from a ruptured fuel tank. NYSDEC Environmental Remediation Division coordinated the contaminated soil clean-up effort.

- **January 23, 2019** - A tractor trailer hauling municipal waste overturned on the shoulder of East Lake Road, between Stanton Road and Woodworth Road, in the town of Spafford. The trailer contents were scattered along a snow-covered right-of-way and an agricultural field. A mini excavator, skid steer and empty trailers were dispatched by the waste hauler to collect and remove the waste. There was no evidence of release of petroleum products or additional fluids.

- **DATE** - The Skaneateles Volunteer Fire Department and City of Syracuse Water Department personnel responded to a report of a motor vehicle submerged in Skaneateles Lake at the Mandana Marina. The vehicle entered the lake via the marina boat launch and was located in approximately 6 feet of water alongside a permanent dock. Removal of the vehicle was coordinated by the Skaneateles Volunteer Fire Department dive team and dispatched tow truck. A petroleum sheen was not observed on the lake surface.

- **April 3, 2019** - City personnel and NYSDEC Spill Response were dispatched to a single-family property in the Hamlet of Borodino regarding a possible release of fuel oil. An approximately 75 square feet of gravel driveway area was saturated / ponded with a petroleum product. Absorbent pads were applied to collect product in areas where the product had ponded. Further investigation indicated the release was the result of an attempt to drain a basement heating oil tank. The spill was the result of transferring the product to storage container. A plastic barrier was placed over the spill area to prevent runoff and infiltration of the product through the soil during storm events until NYSDEC Spill Response could coordinate for contaminated soil removal.

- **May 29, 2019** - A flatbed hauling an aerial boom lift overturned onto a Fire Lane in the Town of Spafford. An estimated 30 gallons of hydraulic fluid and 10 gallons of diesel fluid discharged along the edge of an agricultural field. Absorbent pads were applied to areas where the product collected. The contents of the trailer were off-loaded into the field and removed with heavy equipment and trailers dispatched to the site. A NYSDEC spill contractor completed excavation and off-site removal of contaminated soil along the North side of Pine Bluff Road on May 30.

- **June 12, 2019** - A commercial vehicle hauling crushed glass overturned on West Lake Road, in the Town of Spafford .5 miles south of the Borodino Hamlet. Removal of the damaged vehicle and spilled contents was initiated following the accident. A minimal amount of coolant was observed on the road and shoulder.

- **August 5, 2019** – The City of Syracuse Water Department responded to a NYSDEC Spill Report regarding an unknown quantity of hydraulic fluid discharged onto a gravel parking area off a Fire Lane in the Town of Spafford. NYSDEC Spill Response coordinated the removal of contaminated soil.

- **September 25, 2019** – City of Syracuse Water Department personnel responded to a report of a granular fertilizer discharged along the shoulder of West Lake Road, in the Town of Skaneateles. The material extended approximately one mile along the shoulder. NYSDOT was contacted and dispatched an air street sweeper to collect the fertilizer.

- **November 9, 2019** – A tractor trailer hauling packaged rock salt overturned on the north bound lane of West Lake Road, south of Greenfield Lane. Diesel fuel was not released, however, a minimal amount of coolant was observed in the engine compartment. Numerous bags of rock salt (including the contents of several ruptured bags) were collected and removed from the road shoulder and lawn area.

- **November 13, 2019** – A tractor trailer overturned on East Lake Road, north of Bacon Hill Road in the Town of Spafford. City of Syracuse Water Department personnel and NYSDEC Spill Response were dispatched to the accident. An unquantified amount of diesel fuel discharged on top of snow pack along the road right-of-way was removed with a vacuum truck. Contaminated soil was also scraped, collected and removed offsite. No road ditches our conveyances were identified in the area of the spill.

4.7 Composing Toilet Operation

Currently 50 property owners utilize composting toilets provided by the City of Syracuse. Compost toilet users are responsible for removing finished compost from their units and emptying the compost in clean 5-gallon buckets provided by the City. Finished compost is collected in the spring by City Water Department personnel and placed in 4 foot (w) x 4 foot (l) x 4 foot (d) wooden containers, allowing for additional composting on the City's Glen Haven property. The storage containers have been constructed to allow thermophilic composting (internal temperature exceeding 105 degrees Fahrenheit) to take place, further reducing or eliminating any pathogens remaining from the collected compost. The compost piles are monitored to ensure the required temperatures are attained. Carbon based materials such as grass clippings, mulch and wood chips are added to the piles periodically to maintain a balanced carbon/nitrogen ratio. A balanced ratio allows for optimum digestion of compost by microorganisms, resulting in accelerated temperatures in the pile. Sampling for fecal coliform coincides with monitoring for thermophilic conditions within the compost pile to ensure pathogen reduction. Compost is typically stored for a minimum of three years allowing for a significant reduction in volume and pathogens. Provided that fecal coliform results are below water quality indicator levels specified by New York State Department of Health for bathing beaches, the remaining organic material is mixed within the leaf litter.

5. FILTRATION AVOIDANCE WAIVER

5.1 Filtration Avoidance Waiver Conditions

The City of Syracuse applied for and received a filtration avoidance waiver extension June 28, 2004. The waiver has no termination date, and will remain in effect for as long as the City complies with the conditions of that filtration avoidance waiver.

Progress continues to be made on the programs implemented by the City in order to enhance the Skaneateles Lake Watershed Management Program. The programs are: The Data Gathering and Management Program, Conservation Easement Acquisition Program (now complete), the Skaneateles Lake Watershed Agricultural Program (SLWAP), and the Water Quality Public Education Program.

For a detailed discussion of these programs, refer to the Skaneateles Lake Watershed Program Annual Report 2019-2020.

6. PESTICIDE AND FERTILIZER INVENTORY

6.1 Agricultural Pesticide and Fertilizer Use Survey

The annual Agricultural Survey was conducted by the Skaneateles Lake Watershed Agricultural Program staff. A total of 40 farms were involved in the survey. These farms are actively participating in the Skaneateles Lake Watershed Agricultural Program (SLWAP) with the majority of these farms located entirely in the watershed. A total of 30,272 acres were found to have been worked by the 40 farms with active Whole Farms Plans.

A total of 932 tons of granular fertilizer and 18,765 gallons of liquid fertilizer were applied to cropland. A total of 698 tons of lime were applied to cropland. A total of 7,097 tons of manure, and 15,253,805 gallons were utilized for nutrient value and soil organic matter enhancement. This manure was produced by approximately 2,037 animals (1,641 dairy animals, 52 horses, 99 sheep, 123 beef, 93 bison, 26 alpacas, 3 goats).

A total of 2,792 gallons of liquid pesticide and 2,333 pounds of granular pesticide were applied to cropland. These numbers represent totals for all pesticides (herbicides, insecticides, and fungicides) that were applied at the rate specified by the label.

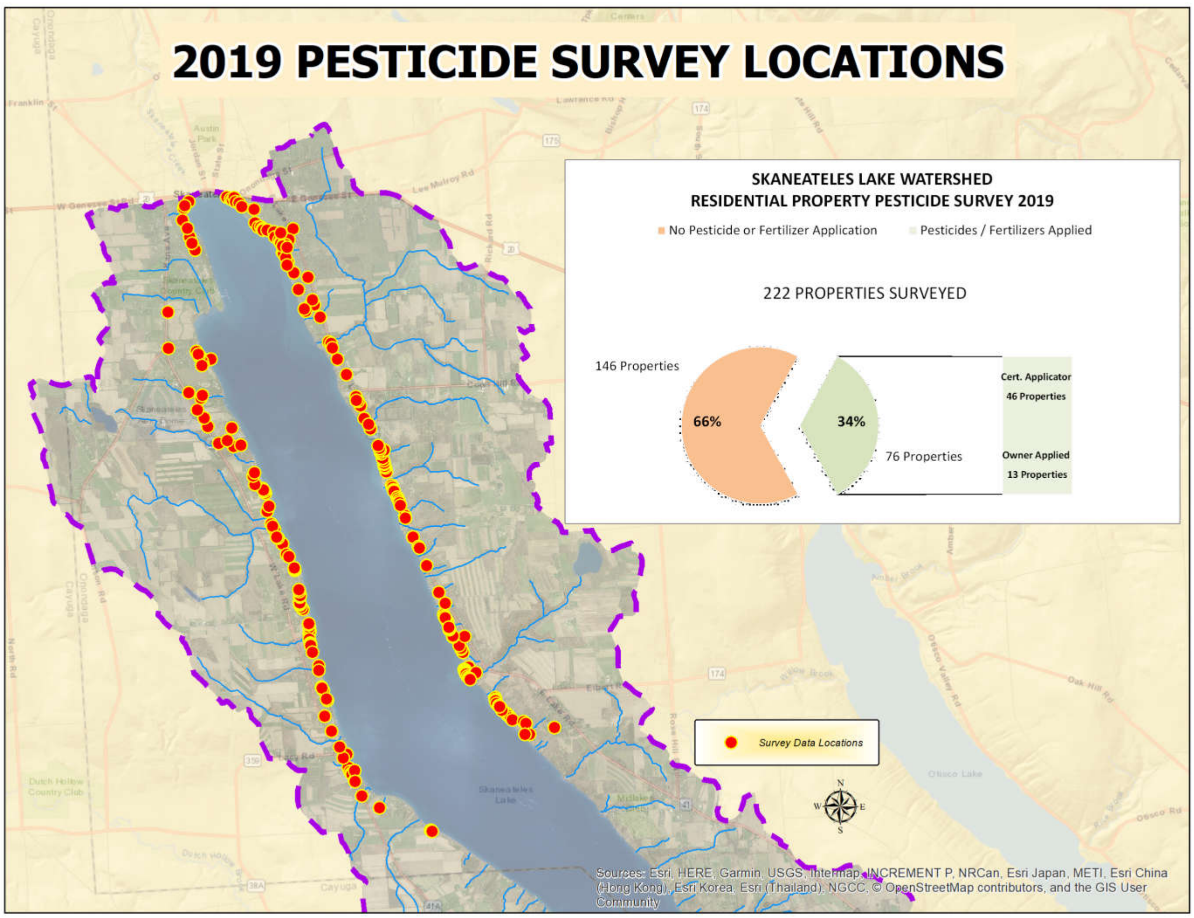
A total of 110,265 gallons of diesel and 21,208 gallons of gasoline were used by the 40 farms.

Watershed Inspectors conducted an annual survey of agricultural operations focusing on petroleum and chemical storage, disposal practices and solid and hazardous waste. There was no evidence of petroleum spills or leakage from bulk storage tanks, dispensers, or hoses during the inspections.

6.2 Pesticide Use by State and Local Departments of Transportation

Herbicides were not used by New York State Department of Transportation (NYSDOT) Region 3, Onondaga and Cayuga Residences of the NYSDOT or the Cayuga and Cortland County DOT's in 2019. The NYSDOT Cortland Residency applied Accord XRT 2, Esplanade, and Viewpoint around guide rails on Route 41 from the Onondaga County line south to the watershed boundary. Onondaga County DOT applied Glyphosate and Durion for shoulder vegetation encroachment (prior to pre-pave) along approximately 1,500 feet of Rickard Road, in Town of Skaneateles. Glyphosate and Sulfometuron methyl was applied for guide rail vegetation control on several road right-of-ways in the Towns of Skaneateles and Spafford. This information was based on personal communication and/or information provided by Regional Engineers for the respective NYS Residences, the Environmental Specialist with the Onondaga County DOT, General Foreman of the Cayuga County DOT and the Superintendent of Highways for the Cortland County DOT.

Figure 16 2019 Pesticide Survey Locations



6.3 Residential Pesticide Survey

A lawn pesticide/fertilizer survey of 222 Skaneateles Lake Watershed residential properties was conducted in 2019 by City of Syracuse Watershed Inspectors. The survey focused on lakefront properties within the northern portion of the Watershed (Watershed Protection Zones A – D) due to the close proximity to the City's water intakes and density of manicured lawns opposed to the southern section of the Watershed. One-hundred and forty six residents or 66% of the property owners replied that they did not use lawn pesticides or fertilizers. Seventy Six participants (34% of those surveyed) replied that pesticides or fertilizers were applied to their property. Forty six applications were performed by commercial pesticide applicators and thirteen applications were completed by property owners.

7. PETROLEUM AND HAZARDOUS MATERIALS INVENTORY

7.1 Inventory

Petroleum products were the most abundant and potentially hazardous materials stored on the watershed. In addition to the petroleum products stored on farms (see above), 16 commercial enterprises and seven municipal facilities stored a total of 48,645 gallons of petroleum products as of January 1, 2020. Gasoline accounted for 33,485 gallons of the total. Other products stored were propane (44,500 gallons), diesel (9,970 gallons), heating oil (1,250 gallons) and used oil (3,940 gallons).

Road salts are used by the local highway departments and the NYSDOT for vehicle safety. There is one covered storage facility in the Town of Scott. The average rate of application of salt or salt/sand mixtures on watershed roads by each agency was unchanged from previous years.

7.2 Road Ditch Survey

All road ditches within the watershed are inspected routinely for contamination sources. Watershed Inspectors document evidence of sewage discharge, agricultural runoff, petroleum spills, etc., on Survey Sheets and take necessary steps to identify the source of contamination through sampling point source discharges and investigating property records.

8. WATERSHED MANAGEMENT PROJECTS

8.1 Approach to Controlling Hemlock Woolly Adelgid (HWA)

HWA was identified in the Skaneateles Lake Watershed in 2014. Once infested with HWA, mature Hemlock trees die within 4 to 20 years. The Hemlock loss and replacement with hardwood species has the potential to impact water quality by altering nutrient cycling in the watershed and changing water temperature and water quantity going into the lake over the course of the year. Hemlocks' deep shade and often streamside habitat helps keep streams cool, and their evergreen shade keeps snow on the ground into the spring, providing cold runoff into groundwater farther into the growing season. Because Hemlocks draw the most water during spring and fall, and relatively little in the summer, they also help stabilize stream flows.

HWA has been found on both Southern shores of Skaneateles Lake. As of February 2020, the northernmost points where HWA has been found are in the area of Fire Lane 22A on the western shore, and around Ten Mile Point on the eastern shore. (For the most up to date information, please visit the NY iMap-Invasives map at https://www.nyimapinvasives.org/data-and-maps). In an effort to minimize the spread of HWA, the City of Syracuse Water Department has collaborated with the Onondaga County Soil and Water Conservation District, Cornell University, Cornell Cooperative Extension of Onondaga County (CCE of Onondaga County) and several volunteers residing with the watershed. In May 2015, 100 Eastern Hemlock trees were planted within this region of the watershed in an effort to grow populations of biological controls to resist the spread of HWA. Once the trees are mature and healthy enough to sustain low populations of HWA, predator insects will be introduced to feed on HWA, and rear a larger population of predator beetles for introduction throughout the Watershed.

8.2 Biocontrols

Three insects that feed on HWA (biocontrols) have been released in the Skaneateles Watershed in 2015 and 2016. These are a beetle referred to as 'Little Larry', Laricobius nigrinus, and two species of silver fly, Leucopis piniperda and L. argenticollis. All three species are imported from their native range in the Northwestern US where they are natural predators of HWA. Establishment has not been verified in the Skaneateles Watershed for any of the three species, but establishment can take many years to be detected.

To enhance and support this biocontrol management option, in November of 2017 a new, $1.2 million biocontrol laboratory was established on the Cornell University campus, focused on researching and rearing biological controls to stop the spread of HWA. The lab is funded through NYSDEC's monies from the NYS Environmental Protection Fund and is headed by a Cornell entomologist.

Biological control is a long-term solution for HWA, but landowners with trees that are currently infested are strongly encouraged to consider treatment of their trees. Treatment is relatively inexpensive and lasts for three - seven years. More information on HWA management options can be found at the NYS Hemlock Initiative website, nyshemlockinitiative.info.

In 2018, the agencies included an HWA-specific iMap-Invasives training in their HWA workshop. iMap-Invasives is an on-line, GIS-based data management system used to assist citizen scientists and natural resource professionals working to protect our natural resources from the threat of invasive species. Attendees learned how to identify and report HWA infestations and, of equal importance, the absence of infestations, around the Skaneateles watershed. Since the training, workshop participants on their own have logged over three dozen entries in the database project shared between CCE of Onondaga and the NYSHI. Including first reports of known infestations in the watershed, this citizen science effort has largely contributed to the NYSHI research, is proving to be an efficient use of agency resources, and aids our partners at the state PRISMs in following early detection, rapid response protocol.

8.3 Watershed Data Scanning Project

Records of septic system designs dating back to the 1930's are archived in numerous file cabinets at the Skaneateles Gatehouse. As the Watershed Protection Program evolves and Watershed Rules and Regulations were updated, documentation collected on individual properties expanded to include all regulated activity involving local health departments, townships and the New York State Department of Conservation. A database which records all activity in the watershed is maintained by City personnel and includes over 150 categories. The database is linked to a GIS database, which allows for tracking of watershed activity such as new housing starts, violations of watershed rules and regulations, OWTS design approvals, etc.

In January 2010 the City initiated the scanning of all file folder documents. The electronic images will allow for indexing of data on individual tax parcels according to regulatory agencies, increase storage space, provide a back-up in the event of a permanent loss and allow for prompt retrieval through a GIS hyperlink. Scanning is conducted by City personnel and is typically scheduled for afternoons during the winter months when there is limited activity and access to property on the watershed. Due to the intermittent scanning schedule and extensive file folders, the project has taken numerous years, however, completion is anticipated in 2020.

8.4 Shotwell Brook Pathogen, Nutrient and Sediment Loading Reduction Initiative

Shotwell Brook is located along the northeast section of the Watershed and enters the Lake within close proximity to one of the City's drinking water intakes. Agriculture accounts for approximately 70% of the land use in the 3.3 square mile Shotwell Brook Watershed. The Land Protection Plan for the Skaneateles Lake Watershed dated June 20, 1995, prioritizes critical management zones and divides the Skaneateles Lake Watershed into six Watershed Protection Zones. The Shotwell Brook tributaries and sub-watershed comprise the three highest levels of protection priority designated in the Report.

High intensity storm events frequently result in substantial sediment loading to Skaneateles Lake from Shotwell Brook. Storm events combined with strong southerly winds may result in sediment plumes which are transported from the Shotwell Brook outlet in the direction of Intake #1, causing elevated turbidity through the intake.

The Skaneateles Lake Watershed Protection Program is coordinating with multiple agencies including the Finger Lakes Land Trust, SLWAP, NYSDEC, Syracuse University, US Fish & Wildlife Service, Onondaga County Water and Environment Protection, the Town of Skaneateles and Upstate Freshwater Institute, to monitor Shotwell Brook water quality and assess impacts of land use in the Watershed on erosion and sediment loads. The objective of the monitoring program is to establish a seasonal (April – October) baseline characterization of hydrology and water quality. The monitoring location was approximately 700 feet upstream from the Shotwell Brook outlet. In 2018 the SLWAP was awarded a $181,000 grant for storm water attenuation on the NE branch of Shotwell Brook. The project, which will be completed in 2020, involves the establishment of a constructed wetland and an extensive floodplain on one acre of fallow agricultural land.

Focusing on a comprehensive multi-agency approach to reducing the amount of sediment discharging to Skaneateles Lake through Shotwell Brook has been and will continue to be a watershed protection priority.

8.5 Subsurface Agricultural Drain Tile Outlet Survey

In 2016 the Watershed Protection Program initiated a program to identify and record GPS coordinates of agricultural subsurface drain tile outlets throughout the Watershed. Watershed Inspectors are surveying every watercourse, road ditch, swale, grassed waterway, etc., that border agricultural fields. Outlet locations and observations noted within drainage ways such as erosion of embankments, excessive algae growth and foam which may be a result of subsurface discharges will be conveyed to the SLWAP for further analysis and possible modifications of Whole Farm Plans. Due to the limited time that can be allocated to the inventory, and the significant amount of land area to be covered (approximately 28 square miles of land use coverage in the watershed is agricultural) surveying all of the conveyances bordering farm land will extend over several years.

9. WATERSHED PERSONNEL TRAINING, CERTIFICATIONS AND PRESENTATIONS

Northeast Aquatic Plant Management Society 20th Anniversary Meeting – January 8 -10, 2019

The Annual Meeting was attended by the City's Public Health Sanitarian. Tuesday's sessions included two Algae Workshops and an Aquatic Plant Workshop. On Wednesday, several presenters from the NYSDEC discussed the New York State HABs program. The afternoon sessions discussed new technologies, including Environmental DNA, Field GIS Data Collection Tools and an Autonomous Aquatic Application System.

2019 New York Association of Conservation Districts (NYACD) Legislative Days – March 4 & March 5, 2019

Representatives from the Onondaga County Soil and Water Conservation District and the City of Syracuse Water Department met with NYS Senators and Assemblymen at the Capitol Building in Albany, NY on March 5. The two day event included briefings by NYACD staff regarding pending bills affecting conservation districts and scheduled appointments with legislators to thank them for their continued support of funding sources to allow local Districts to implement Agricultural Best Management Practices (BMP's).

2019 Water Quality Symposium/NYS CDEA Annual Training Session – March 12-16, 2019

The Public Health Sanitarian attended presentations at the DoubleTree Hotel on March 10 titled Stormwater Management Practices and Source Water Buffer Program, Protecting Drinking Water Sources with Conservation Easements. The Stormwater workshop reviewed inspection protocol, trouble shooting and remediation measures outlined in the NYSDEC 2016 Maintenance Guideline for Stormwater Management Practices. The Source Water Buffer Program presentation included a detailed review of key elements of the application process. The course also provided an overview of conservation easements, including eligibility, the process for acquiring an easement and responsibilities and importance of easement stewardship.

Timber Harvesting Training for Municipalities – May 10, 2019

The Watershed Inspectors attended the training sponsored by the Storm Water Coalition of Tompkins County. Topics discussed included best management practices, effective municipal ordinances and timber harvesting perspectives from a private forester and timber industry forester. The event also included a site visit to a recent timber harvest.

Skaneateles Lake Watershed Municipal Stakeholders Meeting – June 12, 2019

The guest speaker for the bi-annual meeting was a Professor of Water Resources Engineering at the SUNY College of Environmental Science and Forestry. The presentation focused on the benefits of riparian buffers and the implementation of i-Tree Tools to locate vegetated buffers to improve water quality.

2019 Finger Lakes Harmful Algae Bloom Symposium – July 31, 2019

The 6th Annual Symposium was hosted by the Finger Lakes Institute, Corning Incorporated, NYSDEC, and SUNY Fredonia. Presentations included a keynote address from the author of the Green Amendment, Securing our Right to a Healthy Environment and updates from lake associations.

Interactions in the Watershed – 1st NYSFOLA CNY Regional Conference – August 16, 2019

The conference was hosted by NYSFOLA, the Cortland-Onondaga Federation of Kettle Lake Associations (C-OFOKLA) and the Madison County Federation of Lake Associations (MCFOLA). Presentation included Cyanobacteria and HABs, Aquatic Plants and Invasive Species, Our Fisheries, Intersecting Concerns (the role of local government in managing land use and infrastructure) and Funding.

Quagga Mussels: What You Need To Know – August 8, 2019

The event was sponsored by the Partnership for Healthy Watersheds and the Owasco Watershed Lake Association (OWLA). A Professor of Limnology from the SUNY College of Environmental Science and Forestry discussed the impact of Quagga Mussels on Owasco Lake.

Onondaga County Council on Environmental Health Meeting – September 17, 2019

The Public Health Sanitarian provided a presentation to the Council titled; Skaneateles Lake – Copper Sulfate: Historical Perspective/Management Option. The presentation included a discussion on the application of copper sulfate in Skaneateles Lake by the City of Syracuse from the 1930's to the 1970's to control taste and odor algae. The discussion transitioned to the current public health concern of microcystin toxins detected in Skaneateles Lake and a proposal to treat shoreline areas with a chelated copper product.

39th International Symposium of the North American Lake Management Society (NALMS) – November 11 – 15, 2019

The Symposium, hosted by the New England Chapter of NALMS in Burlington Vermont, was attended by the Public Health Sanitarian. Presentations included a full-day workshop on November 11, titled; Advanced Phytoplankton Ecology. Concurrent sessions were organized into ½ day blocks, with several twenty-minute presentations focusing on topics ranging from; Lake Restoration, Watershed Plan Development, Paleolimnology, Phosphorous Inactivation, Source Water Protection & Oxygenation.

SLWAP Annual Meeting – December 11, 2019

The Annual Meeting was attended by the City's Watershed Inspectors and the Public Health Sanitarian. The morning session featured a presentation titled HABs in the Eastern Finger Lakes – Multiple Causes Including Invasive Mussels? The presentation focused on studies of plankton and plant surveys in Skaneateles and Otisco Lakes as well as dive studies and NYSDEC camera measurements of mussel activity in Owasco, Oneida and the Great Lakes ecosystems. The afternoon sessions included a SLWAP 25th Anniversary Presentation by the SLWAP Program Manager.

10. ACKNOWLEDGMENTS

The City of Syracuse continued in its efforts to control pollution within the Skaneateles Lake Watershed in 2019. It is with appreciation that the Water Department acknowledges the efforts, assistance and expertise of the Onondaga, Cayuga and Cortland County Health Departments and the NYS Department of Environmental Conservation Division of Law Enforcement and Division of Regulatory Affairs in the enforcement of the Watershed Rules and Regulations. In addition, the Water Department acknowledges the combined efforts of the City of Syracuse Department of Law, the New York State Department of Health, Natural Resources Conservation Service, Soil and Water Conservation Districts, and the Cornell Cooperative extension for their efforts in assisting the Water Department in its endeavors to enhance the watershed environment.

11. ENDNOTES/FOOTNOTES

1. Lake data excerpted from: Effler, S.W., et al. 1989. Limnological Analysis of Skaneateles Lake, 1988. Upstate Freshwater Institute, Inc. Syracuse, NY.

2. Historically, the City of Syracuse Department of Water has used 59.3 sq. miles or 37,952 acres as the watershed area when calculating the water budget. As of the current re-calculation of land use and cover, the GIS calculates the watershed area as 58.94 sq. miles or 37,720 acres with acreage for Onondaga, Cayuga and Cortland Counties at 19,310, 12,583 and 5,827 acres, respectively.

3. The data is based on the 2010 Census and was supplied by the Syracuse-Onondaga County Planning Agency in October 2011. It is noted that the overall figures show a declining population and increasing number of dwelling units within the watershed as compared to

the 1990 census (noted in previous annual reports). This is due to the way in which the watershed population is estimated. Essentially, a watershed boundary map is drawn over a tax parcel map. There are obvious discrepancies that could occur as a result, but are unavoidable.

4. Average historical data is based upon City data for the 68 years be¬tween 1951 and 2018 inclusive, i.e., total inputs versus total withdrawals plus lake elevation changes.

5. There are two City operated rain gauges within the watershed. One is at the Water Plant in the Village of Skaneatel¬es (Cooperating Observer for the national Weather Service) and the second is located at the southern end of the watershed in the Town of Sempronius on City owned property. Precipitation amounts referred to within this report are weighted values, i.e. 75% of the recorded amount at the Plant plus 25% of the amount recorded at Sempr¬onius.

6. Volume is determined based upon a drainage area of 72.54 square miles.

7. Based upon a lake surface area of 13.6 square miles.

8. This is required by Decision 609B, 1958 between the New York State Conservation Department/Water Power and Control Commission and the City of Syracuse

Appendix

Appendix A – Exhibits

Skaneateles Lake Watershed

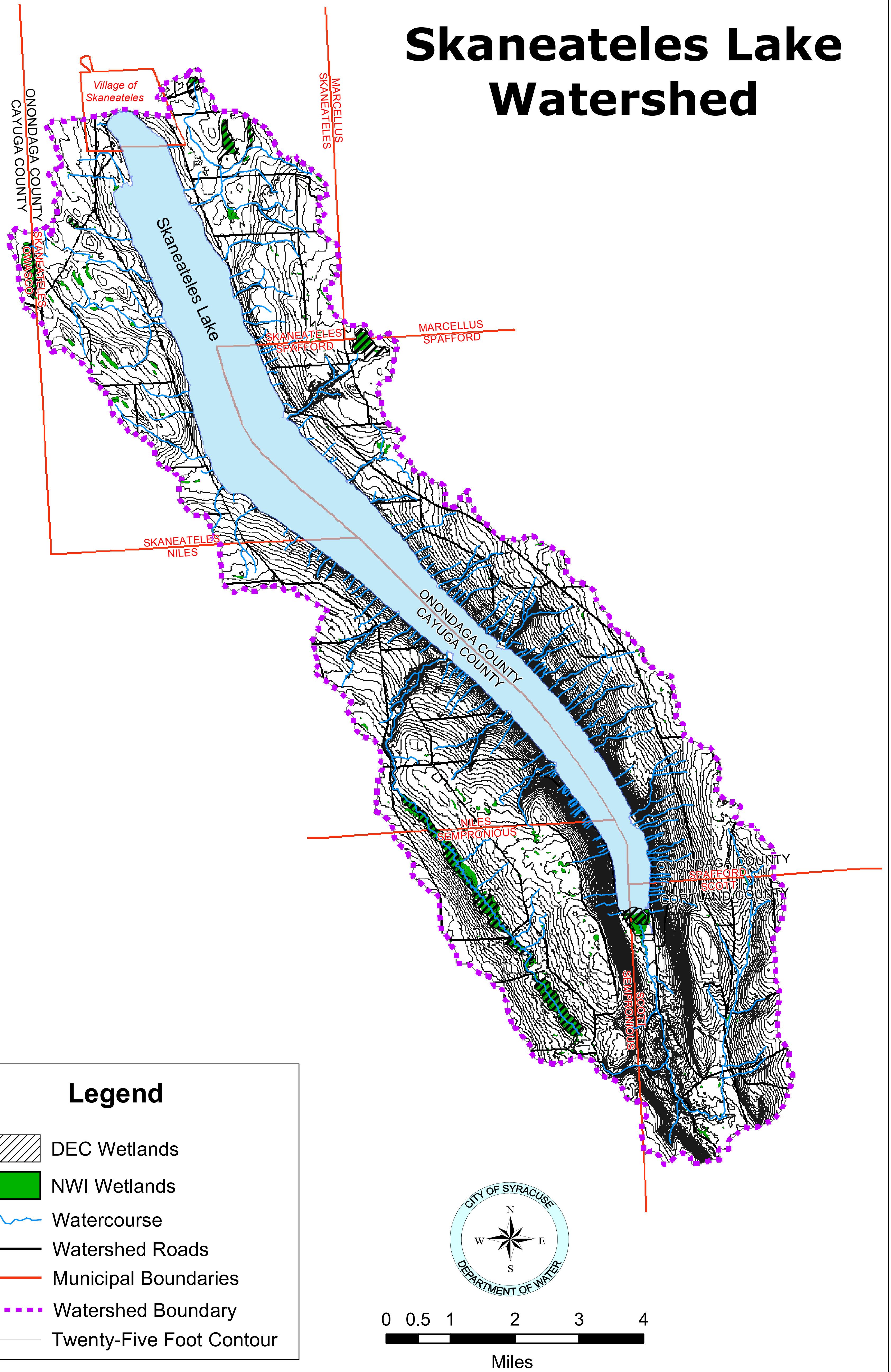


Exhibit A: General Watershed Map

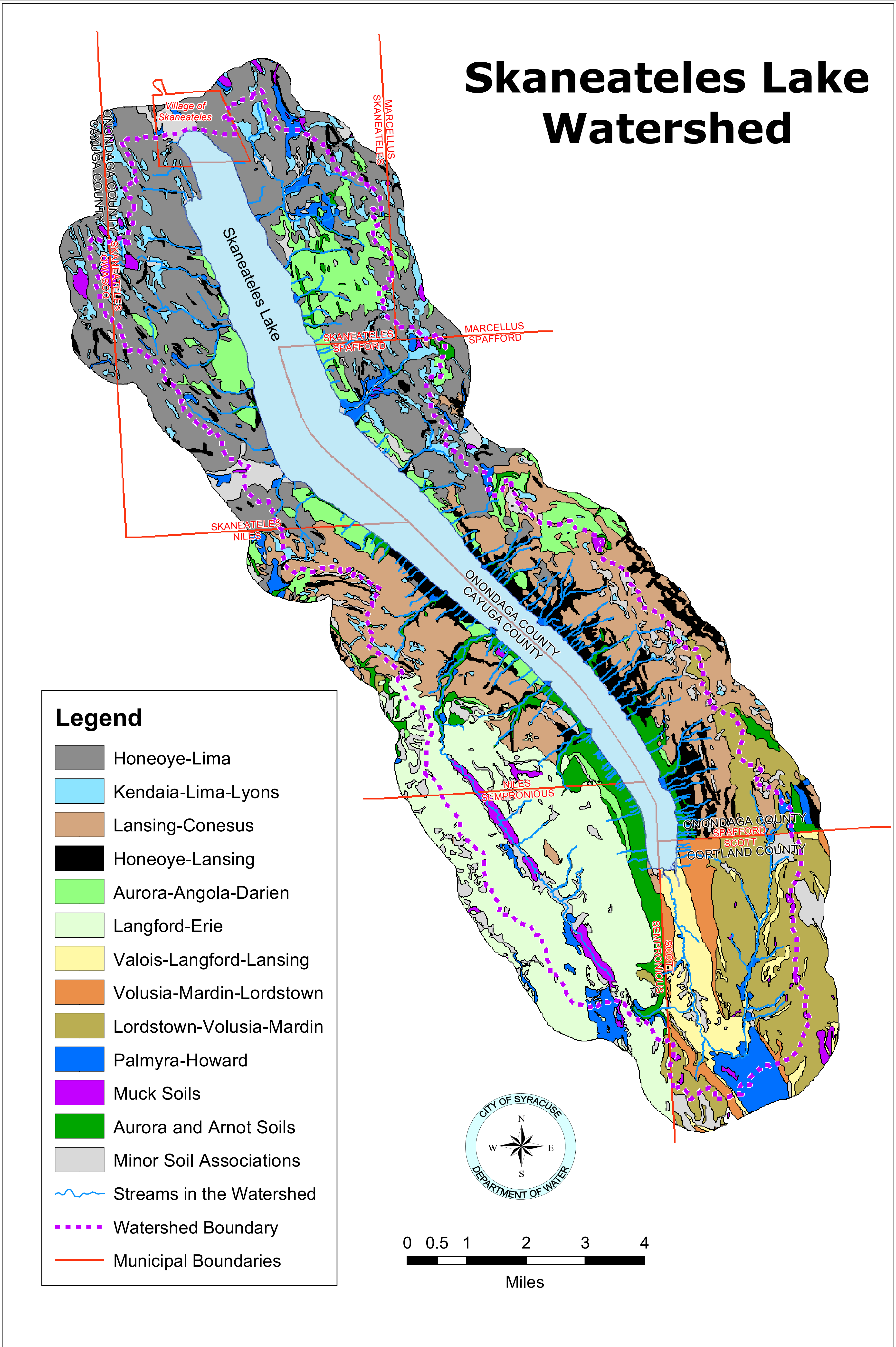
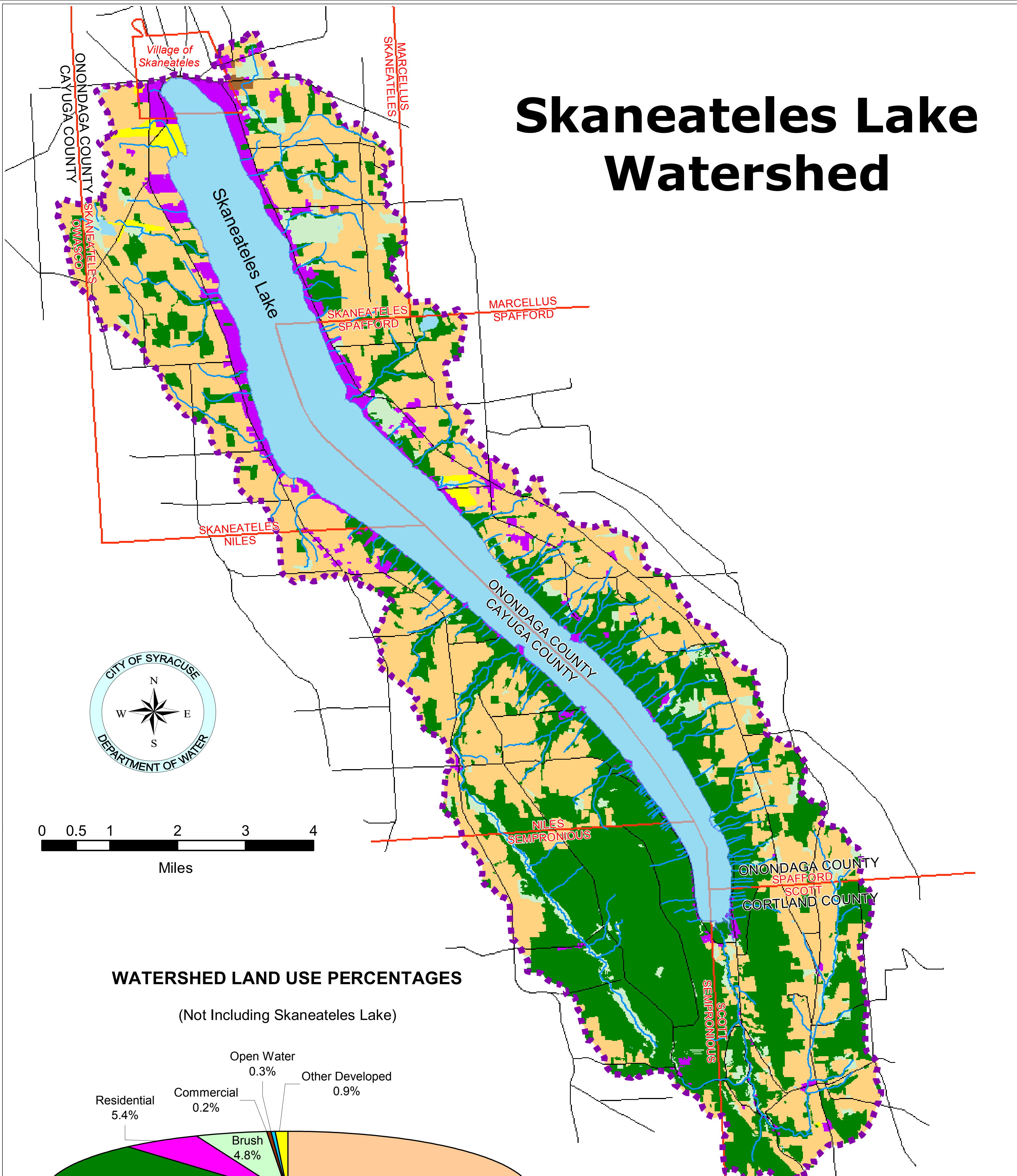


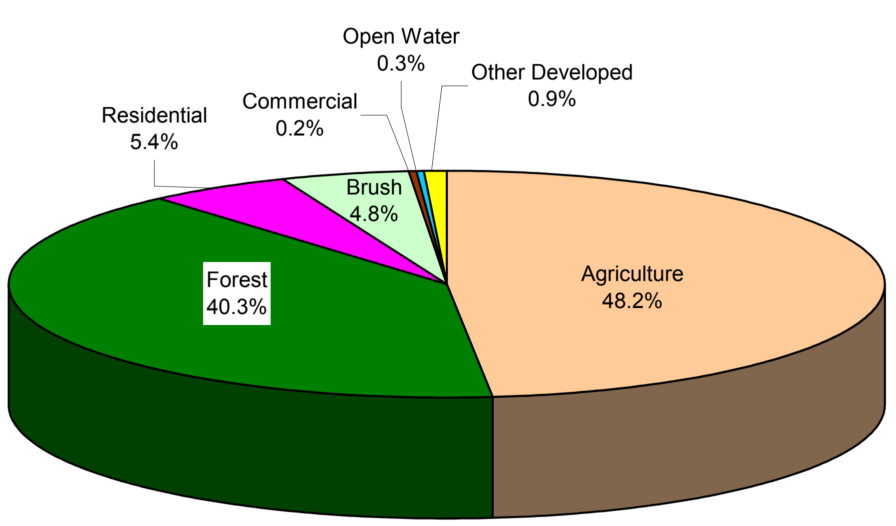
Exhibit B: Soil Associations Map

Skaneateles Lake Watershed



WATERSHED LAND USE PERCENTAGES

(Not Including Skaneateles Lake)



LAND USE BY COUNTY

	Onondaga		Cayuga		Cortland		Total
	Acres	Percent	Acres	Percent	Acres	Percent	Acres
Agriculture	11,291	59.4	4,470	35.5	2,430	41.7	18,191
Forest	4,808	25.3	7,427	59.0	2,977	51.1	15,212
Residential	1,739	9.2	207	1.6	83	1.4	2,029
Brush	1,012	5.3	455	3.6	325	5.6	1,792
Commercial	58	0.3	0	0.0	0	0.0	58
Open Water	85	0.4	22	0.2	9	0.2	116
Other Developed	317	1.7	2	0.0	3	0.1	322

Exhibit C: Land Use Map

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Syracuse
New York