Viticultural Distinction of Seneca Lake in the New York Finger Lakes

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Introduction

The Finger Lakes Region of New York has unique a climate and geology that confer characteristics highly suitable for grape and wine production. The region has many common characteristics, but the orientation, size, and underlying geology does provide differences that provide unique characteristics to each lake. The concept of terroir may be in effect with in the Finger Lakes, but as Pool [1] points out, such designation may be somewhat premature. Nevertheless, accepted wine appelations of the world capture the distinctive factors of the soils, climate, grapes, and production practices within that region.

There are objective factors that can be analyzed to determine to what extent one region is different from another. This paper addresses the Finger Lakes region of New York, and specifically Seneca Lake. The ultimate purpose is to assess whether Seneca Lake is uniquely different from the other Finger Lakes to identify a singular terrior or appelation.

This paper focuses on recent research we have conducted involving precision analysis of local weather conditions on Seneca Lake. This analysis demonstrates special feature of Seneca

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Dr. Seem is a professor of plant pathology who studies the epidemiology of grape diseases. He models and forecast disease, and uses modern technologies of weather forecasting to enhance disease forecasts.

Dr. Magarey is a postdoctoral associate in Dr. Seem's laboratory. He has developed tools for estimating weather conditions within a grape canopy and has implement geographic information systems to assist grape growers to identify potential new sites for grape production.

Dr. Russo is an agricultural meteorologist who is an information provider to the agricultural industries throughout the United States and worldwide. He has developed the technology of local climate information and markets a wide range of weather-related products.

Dr. Zack is a meteorologist who provides local weather forecasts using the mesoscale model, MASS. His business, MESO, Inc., conducts contract research for government agencies and collaborates with ZedX, Inc. to produce a daily, fine-scale weather forecasts for farmers and other businesses.

Dr. Martinson is an entomologist by training, but now serves the Finger Lakes grape industry as the principal point of contact for the Cornell Cooperative Extension Finger Lakes Grape Program.

Lake that enhances the quality of grape production within the Seneca Lake watershed.

Common features of the Finger Lakes

Soils

The underlying bedrock of the Finger Lakes is a principally limestone and shale in the north and sandstone and shale in the south. Although the bedrock gradually changes from the remnants of the Allegheny Plateau to the south and southwest, to the Lake Ontario Plain to the north and northeast (Fig. 1), the lakes do share common bedrock, especially Seneca and Cayuga.

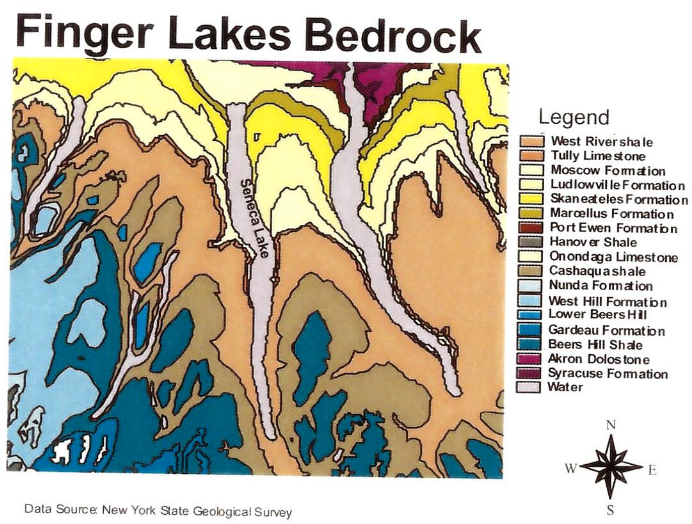

Figure 1. Bedrock geology across the Finger Lakes region of New York State.

Finger Lakes to the east and west of these two central lakes also share common bedrock geology. In general the bedrock consists of the Hamilton, Genesee, Sonyea, Java and West Falls formations, from Middle to Upper Devonian (365 million years old).

The surface geology of the Finger Lakes also has many similar components (Fig. 2). Much of the region is covered with one to three meters of glacial till. In fact till (Till, Ablation Moriane, and Till Moraine) predominates around the lakes with lucustrine deposits at the southern end of Cayuga and Seneca Lakes.

Climate

The climate of the Finger Lakes is not much different than the other grape production regions in New York, with the exception that winter temperatures tend to be colder (Fig. 3). Indeed, the representative data for the Finger Lakes was derived from a weather station at

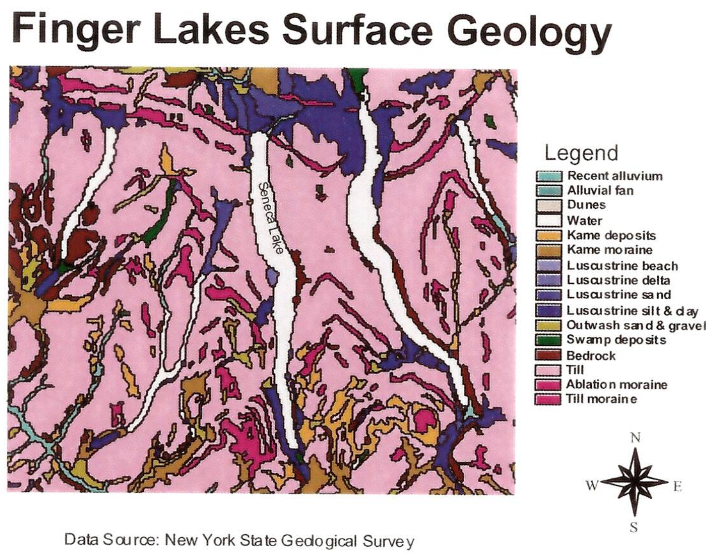

Figure 2. Surface geology of the Finger Lakes region in New York State.

Geneva, NY located at the extreme northern end of Seneca Lake. This station may not represent the higher elevations, and potentially colder regions located at the southern end of the lake.

Climate of the Finger Lakes is based on records maintained by the National Weather Service. The observation stations are limited and do not adequately represent historical climate across the region. We have developed a technology to estimate climate condition at a 1 km^2 scale based on special spatial interpolation [2]. Based on this technology, we have calculated

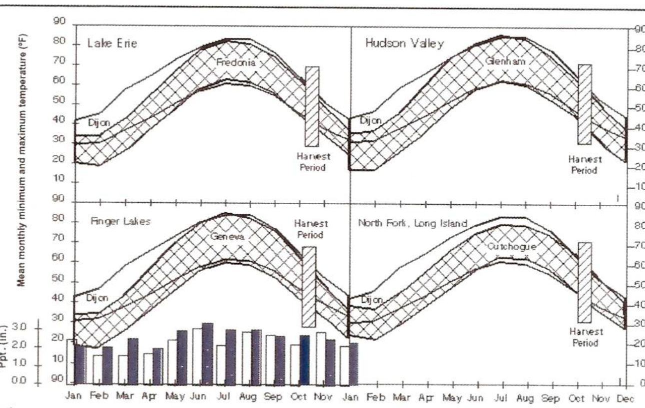

Figure 3. Comparison of monthly temperature ranges for the four grape production regions in New York to the grape production region in Dejon, France. Finger Lakes data come from Geneva, at the northern end of Seneca Lake. (from R. M. Pool)

high-resolution climate factors that are important to grape production: degree days; frost free days, and extreme minimum January temperature. These analyses are presented in Figs 4-6.

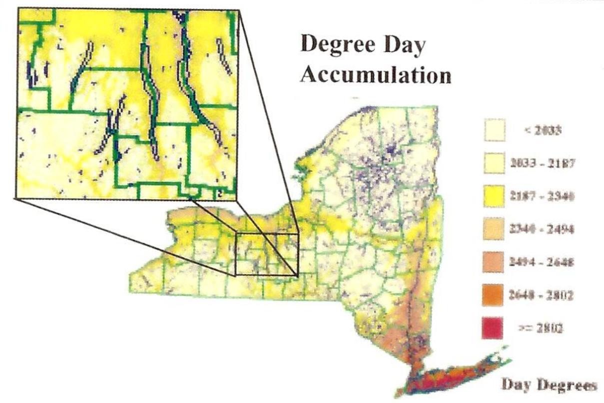

Figure 4. Seasonal degree day accumulation (sum of [daily temperature – 32]) at a 1 km^2 resolution.

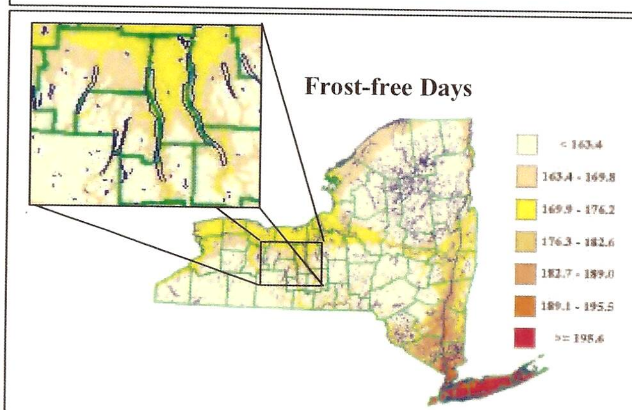

Figure 5. Number of frost free days during a growing season from the last frost in the spring to the first frost in the autumn.

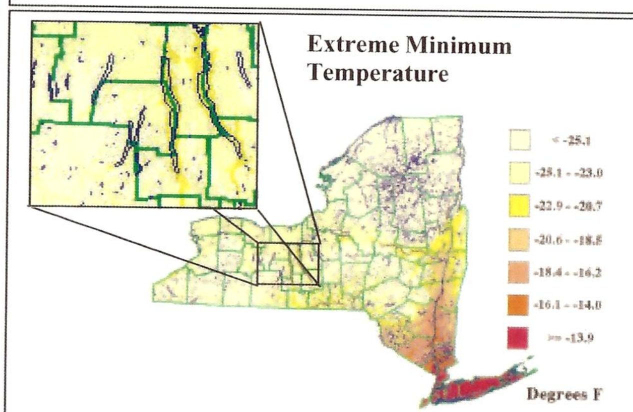

Figure 6. Thirty-year minimum temperature during the month of January at a 1 km^2 resolution.

Based on these three climate factors, the distribution of the values are rather uniform across the Finger Lakes. It appears that even at a 1 km^2 resolution, the unique climate features of the region do not stand out. However, many have recognized that the Finger Lakes do have unique features, some of which can be attributed to individual lakes. Although this method for the analysis of the climate had not proven what many believe to be true, we pushed further and tried different scales of resolution. From the original 1-km grid size in the model, we dropped to a 500-m grid, then 300m, 200 m, and finally, 100 m. It was at these higher grid resolutions that the differences started to emerge.

The distinctive features of Seneca Lake

Then what are the distinctive features of Seneca Lake?

Physical description of Seneca Lake

Seneca Lake is the largest of the Finger Lakes covering 67.7 square miles. The lake is 35.1 miles long and is an average of 1.9 miles wide with a shoreline of 75.4 miles. It has a volume of 4.2 trillion gallons with a maximum depth of 634 feet and collects water from a watershed of over 700 square miles including parts of six counties (Ontario, Yates, Seneca, Schuyler, Steuben, and Chemung). Seneca Lake has a volume of 4.2 trillion gallons with a maximum depth of 634 feet. At 150 feet, the water temperature remains at 39 F (4 C) year around. Above that level, the water does vary seasonally, but the surface temperature generally does not go below 39.5 F (3 C). This means that the lake rarely freezes [remember this point – it is important].

Climate at a fine scale

The unique physical features of the Finger Lakes, and in particular Seneca Lake, create local climate variation. This is due to the latent heat stored in the water and the air drainage across the local terrain. Our recent studies have shown that characterization of climate cannot be done adequately using analysis of typical NWS weather stations. We have collected temperature data around the Finger Lakes using electronic data loggers (Fig. 7) and have compared these data to the data provided by the NWS. Figure 8 shows how an NWS estimate of temperatures (yellow line) on a transect across Seneca Lake underestimates the temperature and shows no local variation. Estimates based on a network of temperature loggers across the Finger Lakes region (green) are closer to the real temperatures, but also do not show local variation. Therefore, traditional methods of estimating climate information across a complex region, like the Finger Lakes, are not satisfactory and do not capture special, unique features. The unique features of Seneca Lake are not captured by traditional method of data collection, so a modeling approach was used.

Modeling the climate of Seneca Lake

Agricultural fields often experience large variations in canopy temperature and moisture conditions over small distances [3-5]. This is especially true for fields that are in areas of complex sloping terrain, adjacent to water bodies or in regions where vegetative cover, soil type

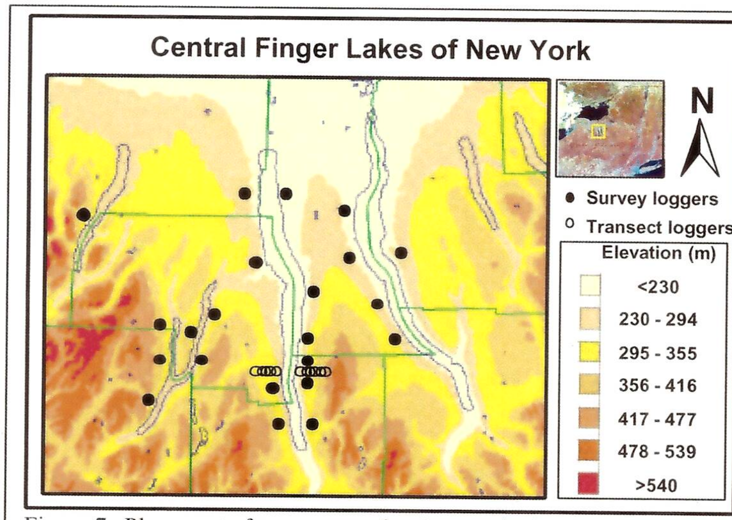

Figure 7. Placement of temperature data loggers in the Finger Lakes weather network (survey) and the cross-lake temperature loggers (transect).

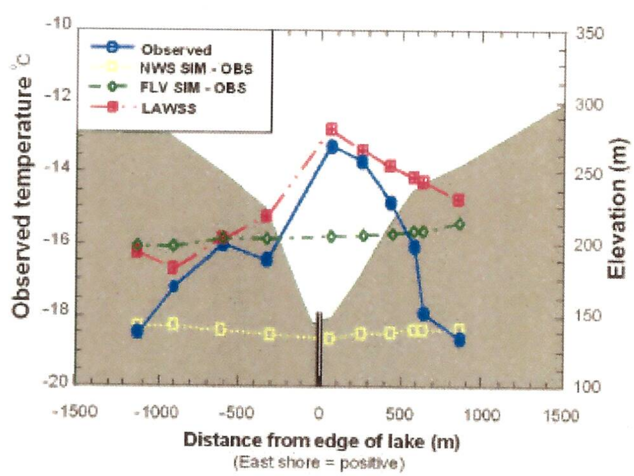

Figure 8. Comparison of three different methods of estimation of temperatures close to Seneca Lake. Ten observation and estimation points were made along a transect across the western and eastern slopes between Glenora and Himrod (Fig. 6). The shaded portion of the graph represents the surface elevation at each point. Electronic temperature loggers were located at each point (blue), and estimates were made using spatial interpolation of data from the National Weather Service (yellow), a network of 20 temperature loggers distributed across the Finger Lakes (green) (Fig. 6), and estimates from the LAWSS model (red).

and moisture and other surface properties are highly variable [6]. The variations in temperature and moisture are often greatest for fields in areas of complex terrain since they are subject to drainage wind flow during clear, calm nights. Since night-time temperatures are important both from the perspective of frost damage and disease development due to dew formation, it is desirable to forecast this horizontal temperature distribution. It may also be valuable to know the distribution of freezing nighttime temperatures in a climatological sense in order to determine if a particular field or part of a field is unusually susceptible to frost. This has particular implications for site selection studies [7].

We created a **L**ocal-area **A**gricultural **W**eather **S**imulation **S**ystem (LAWSS) by simplifying the Mesoscale Atmospheric Simulation System (MASS) [8-9] into a single layer mesoscale (regional) weather forecast model. LAWSS does not include the representation of processes that are usually unimportant in determining surface temperature (especially in nocturnal clear sky, light wind scenarios) such as the parameterization of grid-scale precipitation processes and cumulus convection.

The input data for the LAWSS models consists of upper atmospheric and geographic data. The upper atmospheric data can be either from rawindsonde (balloon) which is archived by the National Atmospheric and Oceanographic Organization or output from an atmospheric model. The digital terrain data or digital elevation model was obtained from the USGS at a 100m horizontal resolution. The landuse data was also obtained as a polygon coverage at 1:250,000 scale from the USGS. Each polygon in the database represented a homogenous are and had a minimum area of 4 ha for urban features and 16 ha for non-urban features.

Lake surface temperatures were specified with the help of temperature profiles collected by HWS Explorer during 1995 and 1999 (H. Ahrnsbrak, unpublished data). The observations were made in the middle of Seneca Lake approximately 4 milers south of the northern end of the lake. From the data it was decided that 3^{o} C represented a useful approximation of lake surface temperature during winter. The variables output buy the model are temperature, wind speed and direction, and relative humidity at 2 meters above the ground surface, canopy temperature and moisture, and surface and soil temperature.

Model output for temperature does follow local conditions. A validation set of observations was made using the transect of data logger across Seneca Lake. Figure 8 depicts model output (red) compared to actual field observations (blue). These results are much better than observed comparisons to extrapolate data from the NWS or local Finger Lakes temperature monitoring networks.

The LAWSS model has shown that heat stored in Seneca Lake can have a very beneficial effect on grape production along the lake. The low temperatures experience during the winter can be mitigated by the release of heat from the lake. Because the lake does not freeze, there can be a continuous transfer of energy from the lake to the surrounding air. The storage capacity of Seneca Lake is much greater than any of the other Finger Lakes and this, its unique influence, will be seen as delayed warming of the surrounding region in the spring and delayed cooling in the autumn. This energy reservoir has been know to actually generate local weather events such as lake effect rainfall, much as the Great Lakes do in areas east of those lakes. At times, this heat transfer process will prevent vines from freezing under extreme low temperatures. This is one of the distinctive features of Seneca Lake.

Examples of how these distinctive feature make the lake unique

Because validation of the LAWSS model is very difficult to acquire, we tested the model using historical cold weather events. Of particular interest was the "Christmas Massacre" of 1980. During this event, a large high pressure system over Nebraska started to pump arctic air across the region and temperatures began to drop suddenly on December 24, 1980 through the morning of December 25. Temperatures started in the upper 20s (F) and ended the period at close to –30 F. Widespread vine damage occurred during the event, although there were pockets where damage was less severe. We ran the LAWSS model to determine if the model could detect where and why some areas were esaped from damage.

Basically the model showed that as the cold arctic air crossed the warm, unfrozen Senec Lake, it was warmed. Vineyards along the southeastern portion of the Seneca Lake district received the benefit of this warmed air and survived the cold event better than other areas,even Cayuga Lake. Figure 9 displays the model output for the southern portion of Seneca Lake at a resolution of 200 meter grid cells. The warmest temperatures are along the southeastern section of the lake where the warmed air moving from the nort-northwest pushed up along the shoreling and actually kept the vines from freezing..

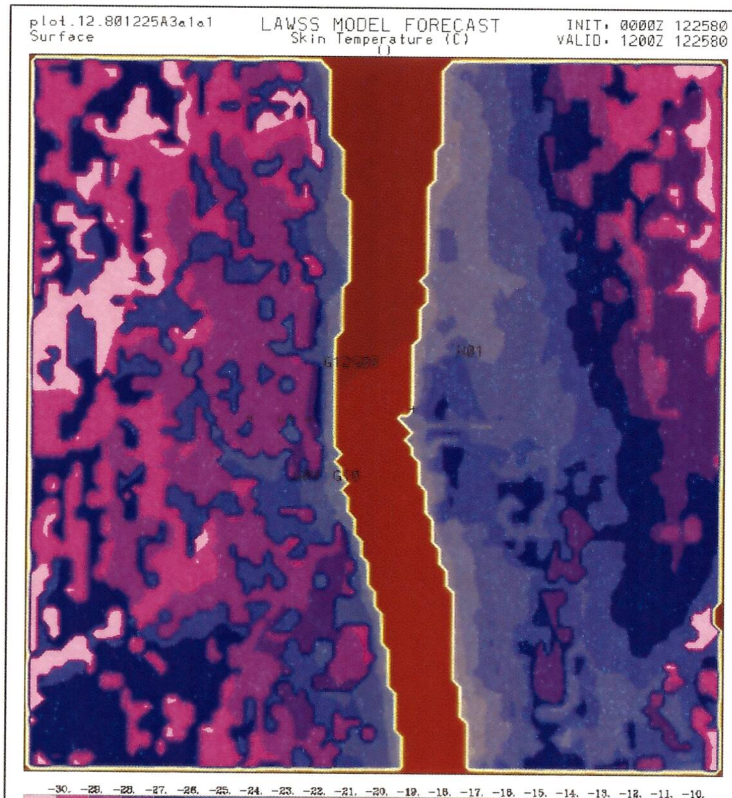

Figure 9. LAWSS model estimation of surface temperatures around Seneca Lake at 0700 local time on December 25, 1980. The model was run at a grid cell resolution of 200 m.

Likelihood of these features found elsewhere

The Finger Lakes represent a unique collection of factors (soils, climate and water) that have limited likelihood of duplication around the world. There are several reasons why. First, grape production worldwide is typically limited to regions below 50° latitude. So grape production in glacial till must occur below (in some cases, well below) the 50^{th} parallel. Glaciers below 50° were not a common occurrence. Among the glacial lakes regions of the world, only the Okanagan Lake region of British Columbia and the glacial lakes of northern Switzerland and southern Germany are exceptions. But the Okanagan region is protected by the Rocky Mountains and really represents the northern limit of the Sanoran Desert. Similarly, the Swiss and German glacial lakes are protected from the arctic cold by the Alps Mountains. Other glacial regions, like northern United Kingdom and the Nordic region, simply do not support grape production.

If the argument that the Finger Lakes is indeed a unique region, then Seneca Lake is unique within that region. The massive water body and the latent heat is can store alters the local climate to the extent that grapes can be grown that otherwise would not survive the cold winter temperatures of early spring or late autumn frosts. Combined with the soils and terrain, Seneca Lake probably holds a unique global niche for grape production.

Summary and Conclusions

Soil and climate are the primary determinants of terroir. While the Finger Lakes region of New York does have unique features of soils and climate from other grape-producing locations around the word, grape production around each lake in the Finger Lakes shares some common characteristics with other lakes within the region. The differences within the region come down to the size of the lake and that lake's ability to influence the local climate.

Traditional methods of measuring local climate have not had the sophistication or detail to quantify the climate modification attributable to the lakes. However, our new methods of local weather and climate modeling allows us to have new insight into climate modification by lakes.

Our models have shown that a lake the size of Seneca has latent heat capacity to influence the local climate around the lake. These modification can take different forms, but the ability to protect a crop from extreme temperatures, either during the growing season or during the dormant season are most important. Smaller lakes, even the size of Cayuga Lake do not have the same levels of latent heat and thus cannot provide the same extent of climate modification.

Based on the information provided in the paper, we feel that Seneca Lake can be classified as unique for grape production.

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Lakewood Vineyards
4024 State Route 14, Watkins Glen, N.Y. 14891
(607) 535-9252

March 21, 2000

Joyce Drake
Petition Chief, Regulations Division
Bureau of Alcohol, Tobacco & Firearms
650 Mass Ave., N.W. Room 5000
Washington, D.C. 20226

Dear Ms. Drake,

I hope I am sending you all the information, concerning Seneca Lake appellation, you requested. I have gone back through my files of things I have sent before and copied them. I hope you have the United States Geological Survey maps I sent earlier. It would be a costly(both time & money) to redo them. I am sending a small map that hi lights the proposed area.

You should have a large color coded land use map that I sent you previously. If you don't have that I think I can get another one made.

I will look forward to hearing from you. I am very anxious to get this project completed.

Sincerely,

Beverly Stamp

Beverly A. Stamp

The Proposed Route for the Seneca Lake Appellation

Commencing in Watkins Glen, New York a small village at the head (South end) of Seneca Lake take Route 414 (intersection of 4th Street & Franklin Street) west .10 mile to Steuben Street heading out of the village. We will travel .40 mile (northwest) to Schuyler County Road 28 out of Watkins Glen. Traveling 1.10 miles to County Route 23 (Mud Lake Road) northwest 4.5 miles. These roads lead us out of the village to the Pre-emption Road. (The Pre-emption Road was part of the Pre-emption Line that was established to settle a land dispute between New York & Massachusetts at the close of the Revolutionary War. This line extended from the Pennsylvania line northward to Lake Ontario. It was a fairly straight line with some deviation.) Traveling approx. 18 miles north to Keuka Outlet (Ridge Road) 2.7 miles on Ridge Road to State Route 54, 1.5 miles west on Route 54 back to Pre-emption Road. Heading north 14.6 miles on Pre-emption Road to County Road 4. This seemed like a natural boundary staying within the Seneca Lake Watershed. Now going approx. 4.5 miles in a westerly direction to Seneca Castle. This area is part of the Seneca Lake Watershed and has natural drainage into Seneca Lake. This area also includes experimental grape plantings of the Geneva Experiment Station. Turn north on the Orleans Road changing to Seneca Castle Road for 2.1 miles to McIvor Road at Warner Corners. Continuing north from Warners Corners on the Wheat Road 2.2 miles to the Tremble Road, 1.2 miles east on the Tremble Road to the Melvin Hill Road, 2.1 miles south on the Melvin Hill Road to McIvor Road, 2.6 miles on McIvor Road. Traveling east to Preece (Priest) Road, .8 miles east to Carter Road, .2 miles north to Skuse Road, 1.3 miles east on Skuse Road, 3.2 miles on Packwood Road to Packwood Corners. East .75 miles on State Routes 5 & 20 to Kendig Creek

Following the creek bed south approx. .5 miles to South River Road, .10 mile west to Knauss Road, 1.1 miles south to Marshall Road, .4 miles west on Marshall Road to Stacy Road, 1.5 miles going south on Stacy to State Route 96A. Following 96A south gives a natural boundary that falls very close to the Seneca Lake Watershed boundaries. Following 96A south 19.1 miles to Lodi, south 4.9 miles on Center Road (county Road 137) to Seneca/Schuyler County Line, .5 miles west to Logan Road (CR4), 8.6 miles south on CR4 to Route 79 .10 miles east to Skyline Drive (CR8) for 3 miles to Cass Road 1.2 miles west to State Route 414, 1.0 miles on Route 414 to starting point in Watkins Glen.

Using these roads for boundaries, we find our way back to our starting point in Watkins Glen.

By using these roads and directions we were trying to stay as close to the Seneca Lake Watershed as we could and have landmarks for identification.

Rec'd 7/13/01 jod

Lakewood Vineyards

4024 State Route 14, Watkins Glen, N.Y. 14891

(607) 535-9252

June 27, 2001

Ms. Joyce Drake, ATF Specialist/Coordinator
Department of the Treasurer
Bureau of Alcohol, Tobacco and Firearms
Washington, D.C. 20226

Dear Ms. Drake,

I talked to you on Monday, June 25th regarding the Seneca Lake Appellation. I have received the material from the Geneva Experiment Station with the information that will show Seneca Lake to be a unique growing area for grapes that are used to produce distinct wines.

I have enclosed the previous narrative on the boundaries of the proposed appellation and another one with some of the reasons for choosing these landmarks. There is also a booklet about the Seneca Lake Watershed.

I sincerely hope this is the information that will set Seneca Lake apart from other areas.

I appreciate all your consideration and time with this.

Sincerely Yours,

Beverly Stamp

Beverly Stamp

Counties included in the proposed Seneca Lake Appellation are Schuyler, Yates, Ontario, and Seneca.

Wineries included in this proposed appellation are Amberg Wine Cellars, Fox Run Vineyards, Seneca Shore Wine Cellars, Anthony Road Wine Company, Prejean Winery, Hermann J. Wiemer Vineyards, Earle Estate Meadery, Four Chimneys Farm Winery, The Barrel People, Glenora Wine Cellars, Fulkerson Winery, Arcadian Estate Vineyards, Lakewood Vineyards, Castel Grisch Winery, Cascata Winery At The Professors' Place, Finger Lakes Champagne House, Chateau Lafayette Reneau, Leidenfrost Vineyards, Red Newt, Hazlitt 1852 Vineyards, Standing Stone Vineyards, Poplar Ridge Vineyards, Silver Thread Vineyard, Shalestone, Wagner Vineyards, Lamoreaux Landing Wine Cellars, and New Land Vineyard.

(a) Evidence that the name of the proposed viticultural area is locally and/or nationally known as referring to the area specified in the petition.

Seneca Lake was named after one of the five nations of the Iroquois Indians. The Indians roamed the area in the 1600 and 1700's. Under the command of Maj. Gen. John General Sullivan the Seneca villages were sacked and burned in retaliation for the Indians support of the British during the Revolutionary War and their attacks on American settlers.

The Senecas have left their mark on the area. We have Seneca Lake, Seneca County, Seneca River, Seneca Castle, Seneca Army Depot, Seneca Lake State Park. There is an organization known as the Seneca Lake Winery Association which most of the above mention 20+ wineries are members.

The February 1997 issue of Wines & Vines, a California based magazine wrote about Seneca Lake area. The author was Philip Hiaring. Mr Hiaring wrote about visiting and interviewing winery owners and winemakers.

(b) Historical or current evidence that the boundaries of the viticultural area are as specified in the petition.

Seneca Lake is part of the Finger Lakes Viticultural region and is one of a group of 11 lakes known as the Finger Lakes. Cayuga Lake viticultural area lies to the east of Seneca Lake. These lakes are divided by definite ridges.
Enclosed is picture taken form R1chard Figiel's book " Culture in a Glass " showing elevations in the Finger Lakes. This picture shows Seneca Lake to be the deepest of the Finger Lakes. The elevations between the lakes give the lakes their own micro climate.

I am also including a map developed by the Yates County Soil & Water Conservation District. The map is of the Seneca Lake Watershed and shows the land use for the area. Our proposed appellation is include in this area.

(c) Evidence relating to the geographical characteristics (climate, soil, elevation, physical features, etc.,) which distinguish the viticultural features of the proposed area from the surrounding areas.

The Seneca Lake Watershed is a large one, 450,000 acres in size. The watershed is primarily a rural one, mainly agricultural and forestland. The topography around Seneca Lake is ideally suited for grapes and other fruit crops. The slopes leading to the lake maintain good air drainage and the temperature of the water provides cool breezes in the spring that prevent early bud break in fruit. In the fall, the influence of the lake delays early frost and in the winter modifies winter temperatures so that bud damage is lessened. This lake effect occurs within about one-half mile of the lake so the tender vinifera varieties are planted within this zone. Hardier American varieties and hybrids can be planted higher on the slopes. Seneca Lake chills down, but rarely freezes during the winter months. Seneca has the longest frost-free period in the Finger Lakes.
Growing Season: Approx. 190 days

Soil: The soils around Seneca Lake consist of various types and many are excellent for fruit.

The effect of numerous glacial advances and retreats is expressed in the soil types. There are well-drained gravelly loam near the lake from glacial outwash. There are various layers of shale, sand & limestone with a shallow layer of topsoil. Seneca Lake was created by the glacial action over a million years ago during the Pleistocene epoch. The moving ice masses deposited a shallow layer of topsoil on sloping shale beds above the lake, providing drainage crucial for grape growing. The band of limestone and shale around the northern portion of Seneca Lake giving a higher pH to the soil. Moving south the soil tends to have a lower pH.

Seneca Lake is one of the Lakes within the Finger Lakes Appellation. Seneca Lake is the deepest of these lakes. It's deepest point is 634 feet. Seneca Lake is the second longest of the Finger Lakes, being 36.5 miles long. Seneca covers 66.3 square miles.

Proposed boundaries for Seneca Lake Viticultural area using U.S.G.S. maps scaled at 1:24,000. Maps used were Burdett, Dresden, Dundee, Geneva North, Geneva South, Lodi, Ovid, Phelps, Penn Yan, Reading Center, Stanley, New York. Photoinspected in 1976

1) Commencing in Watkins Glen, New York, Route 414 (intersection of 4th Street & Franklin Street) west .10 mile to Steuben Street
2) .40 mile (north west) to Schuyler County Road 28 out of Watkins Glen
3) 1.10 miles to County Route 23 (Mud Lake Road)
4) north west 4.5 miles to Pre-emption Road
5) approx. 18 miles north to Keuka Outlet (Ridge Road)

6) 2.7 miles on Ridge Road to State Route 54
7) 1.5 miles west on Route 54 to Pre-emption Road
8) North 14.6 miles on Pre-emption Road to County Road 4
9) Approx. 4.5 miles in a westerly direction to Seneca Castle
10) Turn north on the Orleans Road changing to Seneca Castle Road for 2.1 miles to McIvor Road at Warner Corners
11) Continuing north from Warners Corners on the Wheat Road 2.2 miles to the Tremble Road
12) 1.2 miles east on the Tremble Road to the Melvin Hill Road
13) 2.1 miles south on the Melvin Hill Road to McIvor Road
14) 2.6 miles on McIvor Road, traveling east to Preece (Priest) Road
15) .8 miles east to Carter Road
16) .2 miles north to Skuse Road,
17) 1.3 miles east on Skuse Road
18) 3.2 miles on Packwood Road to Packwood Corners,
19) east .75 miles on States Route 5 & 20 to Kendig Creek
20) Following the creek bed south approx. .5 miles to South River Road
21) .10 mile west to Knauss Road
22) 1.1 miles south to Marshall Road
23) .4 miles west on Marshall Road to Stacy Road
24) 1.5 miles going south on Stacy to State Route 96A.
25) On 96A going south 19.1 miles to Lodi,
26) south 4.9 miles on Center Road(county Road 137) to Seneca/Schuyler County Line ,
27) .5 miles west to Logan Road(CR4),
28) 8.6 miles south on CR4 to Route 79
29) .10 miles east to Skyline Drive (CR8) for 3 miles to Cass Road
30) 1.2 miles west to State Route 414
31) 1.0 miles on Route 414 to starting point in Watkins Glen.

Appellation 9/1?/01

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September 18, 2001

Joyce Drake
Petition Chief, Regulations Division
Bureau of Alcohol, Tobacco & Firearms
650 Mass Ave , N.W. Room 5000
Washington, D.C. 20226

Dear Ms. Drake,

I really appreciate all your efforts on our behalf.

I contacted our Cooperative Extension Grape Specialist for our area and he has given me the figures of 3,756 acres of vineyards in the Seneca Lake Appellation proposal.

My next step was to fax the proposed area maps to the Yates County Soil and Water Conservation District in Penn Yan, N.Y. The figure of 178,789.6 acres was given to me.

We have 3,756 acres of vineyards in 178,798.6 acres of land.

This area is mainly agricultural due to the fairly mild temperatures and fertile soils. Crops raised in this area are grapes, hay, corn, grain, tree fruit, and various types of live stock.

Millions of years ago Seneca Lake was part of a vast inland sea. The great ice age began about 2 million years ago with many massive glaciers moving and churning the soils, leaving sand, gravel, minerals and various debris over the years. This gave the area a wide range of soil types.

Grapevines are capable of growing on a wide variety of soil types, however many soil factors are critical for a vineyard's success. Soils are the result of the weathering of bedrock. New York soils are geologically young and the result of the weathering of glacial material. Melting glaciers produced large rivers and lakes leaving deep deposits of sorted sands and gravels which are the parent material for the soils in some of New York's most important grape growing regions. Three primary types of soils form the bulk of Seneca Lake's vineyards. The northern area has moderate to high limestone content, while the remaining soils of the Seneca Lake area are acidic, silty clay.

"LAKE EFFECT" is a geological and weather phenomenon which makes Seneca Lake such a unique and superb winegrowing region. The deep, glacier-carved lake is nature's air conditioning and heating system, which moderates the temperatures year round. In winter, the lake retains the warmth of summer and fall, protecting the vines from potential deep freezes coming across the Great Lakes from Canada. In spring as air temperatures rise, the large bodies of water warm more slowly and steadily, retarding the growth of buds which could be damaged by a late frost. In summer, the lakes are much cooler than the air, and generate the humidity, which stimulates the production of resveratrol by the grapes. But it's in the fall, during harvest, that Lake Effect is most evident and dramatic. As air temperatures drop, especially at night, the warmer lakes protect the vines with clouds. Cold air, denser than warm, falls to the ground and then slides down through the hillside vineyards to the lakes. The interaction between cold air and warm water creates clouds, staring as mist right on the surface of the lakes. The clouds precisely mirror the shape of the lakes and spread up over the surrounding hills, sheltering the vineyards from the cold air above until the temperature rises and burns off the clouds, allowing the sun to reach the leaves and ripen the grapes." (This was taken from "The Wine Press" 11/4/00, written by James Trezise, President of the New York Wine and Grape Foundation.)

We chose this area of land as the proposed Seneca Lake Appellation to include the areas of land that contained vineyards that were in direct effect from the lake. All drainage of streams and creeks in this area flow into Seneca Lake.

I hope this information completes your needs for our appellation application.

Thank you.

Sincerely,

Beverly Stamp

Lakewood Vineyards
4024 State Route 14, Watkins Glen, N.Y. 14891
(607) 535-9252

April 9,2002

WHF 4/24/02 Kristy

William H. Foster
Deputy Chief, Regulations Division
Department of the Treasury
Bureau A T F
Washington, D.C. 20226

Dear Mr. Foster, +Kristy Colón

Thank you for your patience. I have been collecting the information and maps that you requested for the Seneca Lake Appellation.

The two United States Geographical Survey maps I am including are Montour Falls and Beaver Dams Quadrangles. I am quite sure they include the areas necessary.

After checking with many wineries in the proposed area, no one found it a problem to make the boundary changes you suggested. Schuyler County Soil and Water was kind enough to figure out the approximate acreage added to the proposed area. I am inclosing the map they made for us. This shows an addition of 24,600 acres. Adding this to the original 180,000 acreage gives a total of 204,600 acres.

In answer to your questions about how far Seneca Lake's "lake effect" extends, and how far from the lake does this direct climatic effect extend; I am enclosing copies of pages from "Setting a Course For Seneca Lake" The State of the Seneca Lake Watershed 1999. This book was written with the cooperation of five counties and funded by many state organizations.

The topography around Seneca Lake tends to be steep along its east and west side and low lying to the north and south. The climatic effect of air rising off the relatively warm lake water vis-a-vis the surrounding cold land masses, in the late fall, winter and early spring is such that air is drawn down the east and west hillsides and across low-lying areas to the north and south. The effect of the north and south will carry farther out in either direction due to the lack of obstructing topography.

Most of the land is within 4 miles of Seneca Lake. The effect diminishes as the distance increases, but there would be an effect just the some.

I do hope this gives you the answers you were looking for. I hope I will be hearing from you soon.

Sincerely,
Beverly Stamp
Beverly Stamp

Thank you!

Seneca Lake Watershed
Agricultural Environmental Management

Seneca Lake Watershed

Peter Landre, CCE -Yates County and
Les Travis, Yates County Soil and Water Conservation District

Seneca Lake is an outstanding natural and cultural resource for local residents and tourists. The economic value of the lake cannot be overstated in terms of its benefit to the local community. The lake is "AA" rated and is thus able to serve as the primary drinking water source for over 70,000 people.

Within the Seneca Lake watershed is one of the most diverse and thriving agricultural communities in New York State. Dairy and livestock, vegetable and cash crops, grapes and fruit trees are grown throughout the watershed, primarily on small-scale family farms. The topography and proximity to the lake make this area ideal for vineyards. Overall, agriculture represents approximately 113,369 acres or 33% of the land base.

For over 60 years, soil conservation and land stewardship have been promoted locally. Farmers are considered the original land stewards and, for the most part, have adopted practices that are protective of the Seneca Lake environment.

Setting the Course for Seneca Lake

Setting the Course for Seneca Lake is a comprehensive watershed management program to enhance the economic and environmental health of the watershed. The program is a partnership among dozens of organizations including the Seneca Lake Pure Waters Association, municipalities, county agricultural service agencies, and other organizations that have an interest in or responsibility for protecting beautiful Seneca Lake.

Over the last three years, these groups have worked together to assemble a locally based, objective study of water quality conditions in the watershed. The program was funded by numerous grants totaling over $100,000. The result is a watershed report that identifies sources of pollu-

(WATERSHED, continued on p.2)

(WATERSHED, continued from p.1)

tion and ways to minimize environmental impacts while enhancing the economic vitality of the area. Over 12 potential sources of pollution were studied for the watershed report including lakefront septic systems, roadbanks, streambanks, salt, forestry, agriculture and others. No single land use or group was selected as a target.

In conjunction with this work, a variety of Agricultural Environmental Management (AEM) efforts are underway in the Seneca Lake watershed. As a result of the watershed planning efforts a number of state and federal grants have been received to support water quality improvement projects such as AEM for both agriculture and non-agricultural land uses.

The Agricultural Environmental Management Program

Tom Eskildsen, District Technician Yates County Soil and Water Conservation District

Agricultural Environmental Management, or AEM, is a state-wide agricultural program that has been in place in New York since 1996. AEM is a locally-led program that provides farm operators with a means to address environmental issues related to agriculture. One of the unique values of this program is that participation is on a completely voluntary basis. There are no regulations governing any steps of the program and the farmer is not committed to any projects by going through the process.

The AEM program uses a team approach to provide the best service to the farmer and the environment. The program utilizes the expertise of personnel from the Soil and Water Conservation Districts, Cornell Cooperative Extension, Natural Resources Conservation Service, the Farm Services Agency and the farmer to solve many farm problems such as soil erosion, pesticide management, wet barnyards, and manure management challenges.

Why is agriculture being singled out? Agriculture is not the only source of pollutants being addressed in the watershed. The Seneca Lake watershed management study, "Setting the Course for Seneca Lake," studied twelve different potential sources of pollution. Agriculture was just one of the twelve. Each of these different potential pollution sources is being addressed in order to develop a comprehensive watershed effort to protect the quality of our waters. AEM is part of this watershed-wide effort that involves everyone that lives in the watershed.

How will AEM help me if I volunteer to participate? The overall goal is to help farmers identify projects and management practices that will improve farm operations and protect water resources. The AEM program works on a tiered process. The first step, Tier I, is a simple survey that gathers basic farm information. The second step, Tier II, involves completing review worksheets about various aspects of the farm. Worksheets commonly completed are: manure management, soil management, vineyards, and barnyards. After the worksheets are completed, potential pollution concerns are identified and reviewed to identify where improvements can be made. A plan is developed that protects the environment and fits the farmer's goals for the farm.

With a developed plan, potential grant and cost-share funds may be identified to help implement planned improvements.

Seneca Lake Watershed Agricultural Environmental Management
Cornell Cooperative Extension - June, 2000

"Seneca Lake Watershed Agricultural Environmental Management" is a booklet intended to provide information and education to support the Seneca Lake Watershed farming community. Funding for this publication was provided by a NYS Environmental Protection Fund Grant.

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Having an AEM plan for a farm adds considerable leverage in finding sources to implement water quality improvements on a farm. Cost-sharing can range from 75% up to 87.5% of the total project costs. The Environmental Bond Act, Environmental Protection Fund, and the NRCS Environmental Quality Incentives Program are the most common sources of cost-share money.

This program is designed to help farm owners in the Seneca Lake Watershed. A plan for a farm is developed with the technical assistance of the AEM program staff. Nothing is done on a farm that does not meet the farm's needs. Many farms only need to address one or two areas of concern. In addition, this process documents the good things a farmer is currently doing on the farm to protect the environment.

Soil maps are an excellent tool for understanding soil suitability for crop production.

What Does the AEM Program Address?

- **Pathogens:** *Giardia* and *Cryptosporidium parvum* are two organisms commonly found in livestock feces that can result in human illness. Infants and individuals with immune system deficiencies have the greatest risk for contracting these illnesses. Public and private water supplies drawn from surface water sources are most susceptible to these pathogens. Feces from animals six months and younger are the most likely sources of these organisms. Calf and heifer health management, manure management, and water management around calf housing are areas that would be looked at for potential problems and improvements.
- **Vineyard Management:** The grape growing industry is an important contributor to the community and the environment in the Seneca Lake Watershed. Four vineyard worksheets have been developed by Cornell Cooperative Extension's Finger Lakes Grape Program Viticulture Specialist. These are: Vineyard Site Characteristics, Soil Erosion and Vineyard Floor Management, Nutrient Management, and Pesticide Management.
- **Silage Storage:** Properly stored and field applied silage should cause no pollution problems. However, if silage is not handled and stored properly, seepage may occur and contaminate surface and groundwater. Silage seepage contains high amounts of nutrients and acid which can contaminate the water animals drink and ultimately affect herd health.
- **Petroleum Product Storage:** Gas or diesel fuel can be a serious threat to ground and surface water. Even minor petroleum leaks can cause problems that are not detectable to smell and taste. It only takes a few quarts of petroleum to contaminate a farm's drinking water supply. Secondary containment devices around tanks will trap and hold any leaks.
- **Soil Management:** Soil erosion can be a very serious problem for both a farm and nearby water supplies. Not only does erosion in fields contribute to water pollution, it also reduces the capability of a field to produce crops. Erosion removes topsoil that is the primary source of valuable crop nutrients.
- **Fertilizer Management:** Proper fertilizer application methods, rate, and timing maximize uptake of nutrients by crops and minimize nutrient loss. Fertilizer should be applied uniformly at a rate based on the soil test recommendations. Too much fertilizer will deliver extra nutrients used by non-target plants while too little will result in poor crop yields. Application equipment should be calibrated and maintained. By applying fertilizer just prior to the time of maximum uptake by the crop, a farmer will not allow money spent on fertilizer to be used by weeds.
- **Manure Management:** Manure from livestock is an inexpensive source of nutrients for crops and an excellent soil conditioner if used properly. However, nitrates, ammonia, and phosphorus from manure can enter surface waters and damage their value for recreation and drinking water. The organic components of manure can also damage streams or lakes by robbing them of the oxygen needed for fish and insect life. Because of its potential impact on water quality, including that of a farm's own drinking water, manure should be managed carefully.

Seneca Lake Watershed Agricultural Summary

Les Travis, Yates County Soil and Water Conservation District

The Seneca Lake watershed supports a diverse agricultural base that includes vineyards, dairy and livestock farms, orchards, vegetable crops, cash crops and a few specialty crops. In 1998, agriculture accounted for 113,369 acres or 33% of all land use in the watershed.

During the summer of 1998, the Chemung, Seneca, Schuyler, Ontario and Yates County soil & Water Conservation Districts, in cooperation with Seneca Lake Area Partners in Five Counties (SLAP-5), distributed an agricultural survey to 562 farm operations in the watershed. The purpose of the survey was to identify the subwatersheds where farming practices were potentially contributing significant quantities of pollutants to the lake. The results would also indicate which subwatersheds could most benefit from implementation of best management practices (BMPs) designed to reduce the transport of pollutants off the land and into the water. The survey included questions about crops, livestock, manure, silage, milking wastewater, barnyards, tillage, erosion, soil testing, pesticide use, conservation practices and petroleum storage.

Of the 562 surveys distributed, 343, or 61% of the farms replied, providing a good sample of agricultural practices in the Seneca Lake watershed. The survey results indicate that the Catharine Creek, Keuka Lake Outlet and Kashong Creek subwatersheds have the greatest potential for agricultural pollution. Reading, Rock Stream, Big Stream, Starkey and Long Point subwatersheds were of medium concern. The remaining subwatersheds are of minimal concern in terms of agricultural practices.

The results from the survey were corroborated by comparing them with the results from a computer model used to prioritize subwatersheds based on agricultural land use. Land use, soil characteristics and crop rotations were entered into the model to estimate the sediment and nutrient yields delivered to Seneca Lake. The model compared and prioritized subwatersheds according to their potential to contribute sediment and nutrients from agricultural sources. Based on the computer model, Catharine Creek, Kashong Creek and the Keuka Lake Outlet are the subwatersheds with the greatest pollution potential. Wilson Creek, Long Point, Big Stream and Starkey subwatersheds are of moderate concern. The remaining subwatersheds are of minimal concern for agricultural pollution.

Summary of the Results of the Agricultural Survey

Crops

- The most common crops grown in the Seneca Lake watershed were hay (#1), corn grain (#2) and grapes (#3), which cover 1,992 acres of the watershed. Orchards/fruit were the smallest crop type reported, covering 586 acres. The Keuka Lake Outlet, Kashong Creek and Catharine Creek subwatersheds had the largest number of acres planted.
- Ontario County had the largest number of acres planted with fruit, due to the presence of the Cornell Agricultural Experiment Station.
- Yates County had the most acreage in crops (27,383 acres) in the watershed, while Chemung had the least (1,555 acres).

Animals

- The most numerous type of livestock in the Seneca Lake watershed was poultry (26,549 birds), most of which were located in Schuyler County.
- Most of the dairy cattle over six months of age are in Yates County. The total number reported in the watershed was 8,298.
- There was a combined total of 2,103 deer, ostrich, hogs, goats ducks, pheasants and burros reported in the watershed. Most were hogs and deer.
- There were 1,489 sheep reported in the watershed in 1998, most located in Yates and Schuyler Counties.

(AG. SUMMARY, continued on p.16)

Cropland, including the Cornell University Agricultural Experiment Station orchards, account for 33% of the Seneca Lake watershed.

What's All the Fuss About Phosphorus?

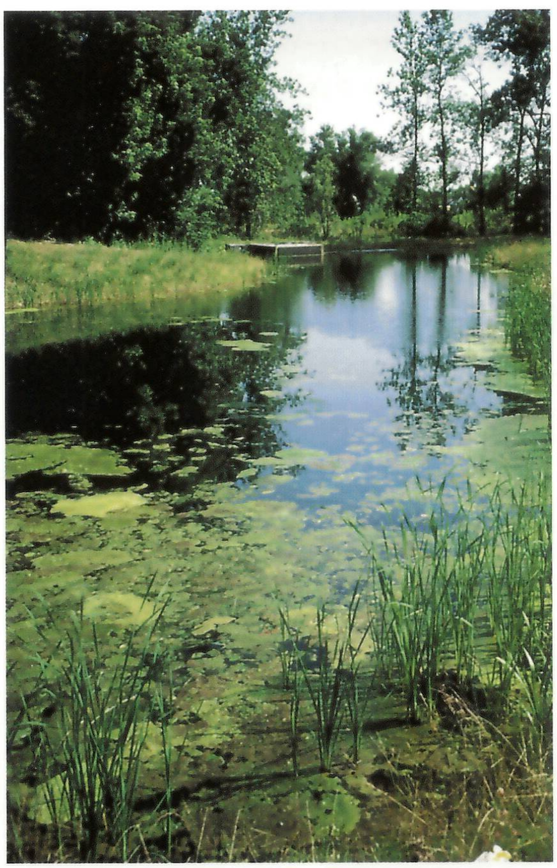
Steve Lewandowski, Ontario County SWCD

Nutrients are the chemicals essential to growth. For plants, the big three nutrients are nitrogen, phosphorus and potassium. Maintaining a good balance of these nutrients, in the presence of adequate sunlight and water, is the basis of the science of agriculture.

But just as a weed is any plant **out of place**, too much nutrient **in the wrong place** is considered a pollutant. In an agricultural field, phosphorus regulates the growth of plant cells and affects flowering and fruiting, but too much phosphorus in water will fuel unwanted plant growth.

In the waters of the Finger Lakes, like most aquatic ecosystems, the factor most limiting growth is phosphorus. In other words, it is relatively the most scarce, compared to other nutrient needs. If more potassium or nitrogen were added to the lake water, there would be very little response in the way of plant (mostly algae) growth. But, if more phosphorus were added, there would be a large response in growth. The process of enrichment of lakes and streams has been compared to the maturation process of living organisms. Adding too much phosphorus causes the lake to age prematurely.

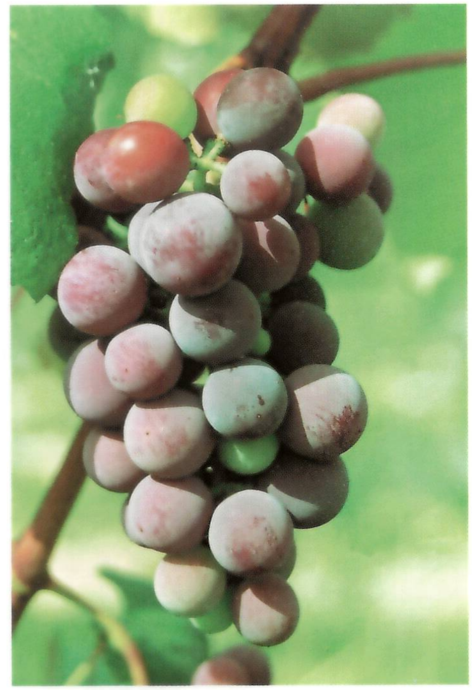
The most common sources of phosphorus in the Finger Lakes watersheds are human and animal waste, farm and lawn fertilizers, and heavy-duty detergents (although phosphorus was banned from laundry detergents in New York State in 1974, large quantities continue to be present in dishwasher and other heavy-duty detergents).



Excessive nutrients can cause algae problems in ponds, lakes and other surface waters.

What can be done to control phosphorus inputs into Seneca Lake? The proper installation, maintenance and inspection of household septic systems will limit direct phosphorus releases to water. Animal manures should be tested for nutrient concentrations and applied at a rate similar to crop requirements. Commercial fertilizers, whether for farm or lawn, should be selected to supply sufficient phosphorus levels. High-phosphate detergents should be used carefully and disposed of properly, or replaced. For example, researchers have been experimenting with replacing detergents used for cleaning dairy equipment with acetic acid.

Limiting phosphorus inputs to Seneca Lake will slow unwanted aquatic growth and the aging process of the lake. Limiting phosphorus inputs will help maintain the high water quality favored by water drinkers, tourists, and riparian property owners.



Soil & Water Conservation Practices for Vineyards

Timothy E. Martinson, Area Viticulture Extension Specialist, CCE Finger Lakes Grape Program

One of the goals of the Seneca Lake Watershed Project is to identify all activities in the watershed that could potentially affect water quality, and to implement practices that reduce the potential to adversely affect this important resource. Grape production, both historically and presently, is a major land use in the watershed. Out of 113,369 acres in agricultural production, 6,847 acres (6%) in the Seneca Lake Watershed are vineyards. Grape production in the Finger Lakes directly contributes $20 million to the regional economy. Processing of the grape crop by the 60 wineries and juice processors in the Finger Lakes and associated tourism contribute even more to the local economy.

Grape growers have long recognized the need for conservation practices—both for

(CONSERVATION, continued on p.6)

(CONSERVATION, continued from p.5)
conservation and economic reasons. Because grapes are often grown on hillsides, profitable production of grapes requires close attention to soil conservation practices. Eroded soil is not productive soil, and nonproductive soil leads to nonproductive, less profitable vineyards. So what are the practices grape growers are using to protect the soil and water resources in the Seneca Lake Watershed? In this article, I will describe the numerous practices currently used by grape growers.

Diversion ditches route water around vineyards, reducing soil erosion.

Soil Conservation

The key to preventing contamination of lake water by soil, fertilizers and pesticide residues is soil conservation practices. Fertilizers and pesticides applied to vineyards that leave the site of application most often do so in association with soil particles carried in surface runoff. Soil conservation practices maintain clean water three ways. First, **diversion** of water around vineyards keeps water clean, because it doesn"t wash over disturbed soil in the first place. **Filtering** water through soil (drainage systems) and ground covers removes soil particles and other material suspended in water that passes through vineyards. Finally, **ground covers** provide a protective barrier that breaks the force of raindrops that could otherwise dislodge soil particles. Key soil conservation practices used in vineyards are:

- **Diversion Ditches.** Diversion ditches are soil structures constructed at intervals across the slope. They collect water from slopes and divert it into natural drainageways. They are seeded and gently graded, and slow the water down so that suspended soil

Cover crops planted with no-till seeders reduce erosion during fall, winter, and spring. After being mowed and killed with contact herbicides in the spring, decomposing rye stubble also prevents weed seeds from germinating.

Soil conservation practices help assure a bountiful grape harvest.

particles can settle out. They can reduce the amount of water running through a vineyard by up to 80%.

- **Buffer Strips.** All vineyards require headlands and grassed areas around their perimeters to allow machinery to turn around. These grassed areas also protect natural drainageways by filtering surface water that leaves vineyards before it gets to streams and drainageways. Generally, about 40 feet of headland around vineyards is adequate for a buffer strip.

- **Drainage Tile.** Subsurface drainage tile, commonly used in area vineyards, also helps protect water quality in two ways. Drainage tile reduces surface runoff that would otherwise occur when soils become saturated with water. It also allows water to be filtered through the soil, which removes many contaminants that would be present in surface runoff.

- **Vineyard Layout.** Planting vineyards so that the rows run across the slope rather than up and down the slope can reduce erosion by up to 50 percent. This practice is common, because most slopes surrounding the Finger Lakes face east or west. Planting across the slope allows vineyard rows to be oriented north and south, which allows for maximum sunlight interception as well as soil conservation.

- **Vineyard Floor Management.** This is the area in which changes in grape production practices have undoubtedly had the greatest positive effect

(CONSERVATION, continued on p.8)

Some grape growers are using on-site weather monitoring equipment to improve the timing of fungicide applications.

(CONSERVATION, continued from p.7)

on reducing soil erosion and improving water quality. Until the early 1980s, most growers practiced clean tillage between vineyard rows. This method of weed control, which involved up to four or five passes through a vineyard annually, left vineyards vulnerable to soil erosion during much of the growing season. Its use from the 1800s on has left a lasting legacy of highly eroded land, some of which no longer supports profitable grape production. Currently, there are many floor management options available that reduce soil erosion while eliminating unwanted competition from weeds. Current herbicides allow growers to maintain a 30-inch wide weed-free strip under the vines while leaving **permanent sod** in row middles. **Straw mulch** is commonly applied in row middles, especially in eroded sites with less vigorous vines. Although expensive to apply, it has many beneficial effects—it conserves soil moisture, increases availability of soil nutrients, provides a barrier to reduce the force of rain drops, and can directly increase yield by up to 20 percent on some sites. **No-till seeding** of row middles is another practice used by some growers. Typically growers seed cereal rye in the fall, which germinates before winter. It then resumes growth in early spring, and is later mowed or killed with a contact herbicide. The decomposing straw left behind also has chemical substances that prevent new weeds from germinating and extends the "weed-free" time. Reduction of tillage, while reducing soil erosion, also has the added benefit of allowing more timely operation of equipment after rainfall and reducing soil compaction from machinery.

Inputs

Soil conservation practices can greatly reduce the potential for soil erosion and surface water contamination. The other side of the coin are the inputs—fertilizer and pesticides—necessary to produce a crop. How do grapes stack up compared to other crops, and what practices are growers using to manage these inputs?

Fertilizer

With respect to water quality, nitrogen (N) and phosphorus (P) are the two most important potential contaminants. These elements can be in excess where animal manures are spread, or where amounts of chemical fertilizer in excess of the crop's needs are applied. Nitrogen is more of a concern with ground water, while phosphorus is the most important nutrient affecting surface water. High levels of phosphorus lead to excessive growth of algae. Other fertilizers, such as potassium (K) and magnesium (Mg), are less important contaminants because they are less mobile within the soil.

The most common fertilizers applied to grapes are nitrogen and potassium. Mature vineyards do not require additional phosphorus because grapes are a permanent crop with deep root systems that can obtain sufficient amounts of phosphorus for the plants' needs. For this reason, grape production contributes little phosphorus to the watershed. Nitrogen is commonly applied at rates of 30 to 100 lb/acre to vineyards. However, timing and application methods can greatly affect utilization by grapevines, and losses from leaching or volatilization (evaporation).

Practices used to manage fertilizer use in grapes are:

- **Soil and Petiole Tests.** Soil samples provide important information about the level of nutrients available to grapevines; leaf petiole (tissue) samples are useful in determining what levels of nutrients are actually being taken up by the plant. By using these tools on a regular basis, growers can "fine-tune" their fertilizer program to avoid deficiencies and excesses of nutrients needed for efficient production.
- **Split Nitrogen Applications.** Until recently, growers applied nitrogen early before bud burst to ensure that it would be available during the entire vegetative growth cycle in the first half of the growing season. Research has demonstrated that early growth depends on reserves stored within the

roots and canes, and that little uptake occurs until new root growth starts, generally three to four weeks after bud burst. Growers now commonly use split nitrogen applications, with the first portion applied after budbreak and the remainder after bloom (late June). This practice matches fertilizer timing with periods of maximum use by the vines, and thereby reduces losses to the environment.

Scouting vineyards for insect pests helps growers determine the need for insecticide applications.

Pesticides

Controlling insect pests, disease organisms, and weeds is crucial to successful grape production. Pesticides are necessary tools in this effort. As I mentioned previously, soil conservation practices are very important in limiting movement of pesticides away from vineyards. However, growers are also using a variety of techniques under the umbrella of "Integrated Pest Management", or IPM, to efficiently use pesticides only when economically justified. Some of these practices are:

- **Insect Scouting.** Insect pests generally are visible to the grower before economic damage to the crop occurs. By regularly scouting vineyards to see what pests are present in what numbers, growers can make spray decisions based on what is in their vineyard, rather than based on a fixed "spray schedule". This approach has resulted in well documented reductions in the average number of insecticides applied, from three to four per year in the 1980s to an average of 1.3 per year in the most recent USDA survey of New York grape growers.

- **Disease Forecasting.** Research on disease cycles and weather conditions has led to some remarkable gains in defining "critical periods" for applying fungicides to control diseases. Unlike insects, disease organisms are invisible until it's too late to stop crop loss. Preventing disease establishment early in the growing season can reduce the need for "rescue" applications late in the season. Use of on-site weather stations to monitor conditions (generally, temperature and leaf wetness) favorable for infections is becoming common. By knowing when an "infection period" has occurred, growers can adjust spray timing accordingly. Also important has been recent information demonstrating that grape clusters become progressively more resistant to infections as they grow. This has given growers the information necessary to be able to stop fungicide applications when grapes reach the proper stage of development and are immune to new infections.

- **Canopy Management for Diseases.** Another recent innovation is the use of training systems for certain grape varieties that reduce shading by foliage around the grape clusters and expose them to sunlight. Upright shoot positioning producing a flat, vertical vine canopy, and leaf removal in the fruit zone provide several benefits. An important benefit of this practice is that it allows rapid drying of the fruit zone and better penetration of spray materials, which greatly reduces bunch rot, a major disease in premium wine varieties. Exposure of grape clusters to sunlight also enhances development of desirable flavors that contribute to wine quality.

The practices I have described are all important elements in maintaining the excellent water quality we enjoy in the Seneca Lake Watershed. They are also practices that make economic sense to grape producers in the watershed. Use of soil conservation practices helps ensure the long-term productivity of vineyards, while protecting water quality. Efficient use of fertilizer and pesticide inputs directly improves the bottom line. For a 100-acre vineyard operation, each spray applied to the vineyard represents an investment of $2,000 to $3,000— ample motivation for avoiding "recreational spraying". Continued innovation by area growers and researchers will be a key factor in maintaining the economic viability of the industry and protecting soil and water quality in the Seneca Lake Watershed and the Finger Lakes.

For more information about any of these practices contact:

Timothy E. Martinson
Area Viticulture Extension Specialist, Finger Lakes Grape Program.
315-536-5134

Best Management Practices – Do They Work?

By John Terninko, Water Resources Consultant

Best management practices, or BMPs, include a wide range of techniques, from cultivation practices to construction of manure storage facilities designed to reduce runoff. They have been advocated by watershed managers, agricultural specialists, state and federal agencies, and other environmental organizations as one of the primary tools for preventing agricultural contaminants from entering local surface and ground waters. The primary contaminants of concern are nutrients (nitrogen and phosphorus), pathogens and sediments. But the list of contaminants also includes pesticides, herbicides, organic materials and other substances. The question is, "Do BMPs actually reduce the transport of these pollutants off site or reduce the amount entering our water resources?" The answer is a firm "Most of the time."

A definitive answer is not possible due to the many variables that can impact the effectiveness of BMPs. Most BMPs use one or more simple concepts: 1) reduce or eliminate use of the contaminant from the farm's operations, 2) ensure that potential contaminants stay on site by reducing the amount of water running off site or by limiting the ability of water to remove the substance, and 3) collect and remove pollutants leaving the site before they can enter ground or surface waters. Many farms in the Seneca Lake Watershed have already used these concepts to protect the environment as well as to prevent topsoil loss and reduce operating costs.

Reduce or eliminate: One way that farmers are reducing costs and preventing pesticides from entering local waters is through the proper use of an integrated pesticide management program (IPM). Visual inspections, including sampling of both crops and pests, can provide cues both for which pesticide to use and when to apply pesticides. Proper handling, use, placement, storage and disposal of pesticides can help ensure that the proper pesticide is used, while reducing pesticide use, preventing spills, and protecting those handling the pesticides.

Keep it on site: There are many examples of BMPs designed to keep potential pollutants where they belong, including:

- Strip cropping – which reduces soil loss.
- Timing of manure application – spreading manure when the crops need it or applying it to fields when there is no threat of rain.
- Keeping "clean" water from entering barnyards – which reduces the potential for runoff by reducing the amount of water flowing through the barnyard.

Collect and remove: Some of the most familiar examples of BMPs that utilize this concept are sediment basins, filter strips, constructed wetlands, and waste water systems. These practices collect or filter runoff by giving plants and microbes time to take up nutrients or break down unwanted compounds, allowing contaminants time to be absorbed by the soil, and/or allowing eroded soils to settle before the water evaporates or slowly flows out of the structure.

When used correctly, a single BMP or combination of techniques can significantly reduce the amount or concentration of contaminants being washed off the land and into surface or ground waters. In Wolcott (Wayne County), NY, for example, one dairy operation installed a constructed wetland to treat their milk house effluent. The result was a 93% decrease in phosphorus concentration between the time the milk house wastes entered the wetland and "treated" water was discharged from it into Wolcott Creek. Other studies have shown similar results:

- *Delaware*: Water quality monitoring in the Appoquinimink River project documented a 60% decrease in phosphorus and a 90% decrease in sediment reaching an impaired water body as the result of implementing conservation tillage and animal waste management BMPs. Improved fertilizer management cut the pre-

Strip cropping on steep slopes helps to reduce soil erosion.

Gutters on farm buildings divert clean water away from barnyard areas, reducing the removal of barnyard wastes.

project phosphorus application rate in half.

- *Utah*: Animal waste management systems decreased phosphorus concentrations in Snake Creek and, as a result, reduced the impact of agricultural activity on Deer Creek Reservoir, an important water supply for Salt Lake City, Utah.
- *Florida*: Fencing, water management, and animal waste management systems in the Taylor Creek-Nubbin Slough project have reduced phosphorus concentrations in water entering Lake Okeechobee by more than 50%, exceeding project goals.
- *Oregon*: Innovative animal waste management systems installed on dairies in the Tillamook Bay project reduced bacterial contamination of oyster beds in the bay, resulting in the re-opening of shellfish beds to commercial and recreational harvesting.
- *Vermont*: A study in the St. Albans Bay area documented significant reductions in pollutant runoff as a result of changing from the common practice of spreading manure on frozen ground to manure management BMP in association with waste storage structures. Significant reductions in indicator bacteria levels were documented in tributaries. Violations of water quality standards at the public swimming beach decreased.
- *Alabama*: One hundred percent of the critical area treatment goals of the Lake Tholocco project was achieved with BMPs designed to reduce sediment and fecal coliform bacteria delivery in runoff from surrounding cropland. The resulting reductions in fecal coliform levels made possible the re-opening of the lake to fishing, boating, water skiing and other recreational uses.

Though BMPs have great potential for alleviating identified pollution sources, these practices can be ineffective or have a limited life span if incorrectly installed or used, or if not properly maintained. This is often due to improper use of the BMP(s). Any BMP is designed to address certain very specific problems and may or may not be able to control another type or source of pollution. For example, while detention basins can be effective at removing sediment and pollutants such as phosphorus, such structures will not remove nitrates dissolved in the water. The same basin can be rendered ineffective at removing sediments if it is allowed to fill in through improper maintenance, enabling sediment laden water to flow through the structure without dropping the suspended solids.

Additional problems can result from ineffective or incomplete monitoring of a BMP's impact on water quality, leading to future decisions based on erroneous conclusions. This can happen, for example, when an insufficient period of time has elapsed since initiation of land treatment to allow measurement of water quality changes. This is more likely with techniques that use vegetation to reduce erosion or remove nutrients. It can take years before the vegetation is fully established and the BMP is 100% effective. Other detection problems may arise when the treated system is a relatively insignificant contributor to the problem. For example, the results of changes in agricultural activities can be masked by non-agricultural pollution sources or the accumulated internal pollutants in a stream or lake. This can result in an inability to document improved water quality despite demonstrated reductions in pollutant loading resulting from implementing agricultural BMPs.

So, again, to answer our initial question, yes, BMPs can be effective tools to reduce the amount or concentration of pollutants entering surface or ground waters. However, that "yes" assumes that 1) the true source of the pollutant has been identified, 2) the correct BMP is chosen for the identified pollutant source, 3) the BMP is installed and maintained correctly, and 4) all else remains equal (e.g. no 50 year storm events, no new land disturbances, no significant changes in farming practices, etc.). To ensure that each of the first three assumptions are correct, farmers should make use of the expertise of local agencies such as the Soil and Water Conservation Districts, Cornell Cooperative Extension and the National Resource Conservation Service.

Concrete barnyards allow easy removal of manure and other barnyard wastes and make it easier to control runoff.

Soil Testing - It Pays!

By Nate Herendeen, CCE Area Field Crop Specialist

If you had $10,000 worth of 6-24-24 sitting in your farm storage shed, would you order more for next season? If you did not know it was there, you probably would. But, you check and monitor your inventory. You know what's on hand and plan accordingly.

That's what soil testing is – an **inventory of the nutrients available.** Soil testing should be the basis of all nutrient management decisions. Knowing what's available can save the unnecessary expense of buying something that's already available at home.

Soil testing can be easily accomplished in the spring, summer or fall. Fall soil tests give farmers and advisors the most time to plan for next year's nutrient needs. Summer testing may give more time to apply lime and have it react to promote best crop growth next season. On acid soils, lime needs six months to react to bring about significant improvement in soil pH.

Experience with pH mapping has shown that surface pH levels are the greatest fertility variable in most fields. While taking soil samples for composites, it is a good idea to carry a pH test kit and check those places where you know crop growth has been poor. Spot applications of lime may be all that's needed.

At over $30/ ton spread, applying lime can be a costly error if not all of a given field needs it. In addition, some of the newer herbicides do not perform well at pH levels greater than 7.0. You already know that the triazine herbicides do not perform well at low pH levels. Most of the time, acid soil areas are the reason for poor crop performance when we troubleshoot problems in the field.

Smart sampling means composite sampling according to soil type. The local county soils map is the best place to start determining how to sample a field. Problem areas within a field should be sampled separately. Keep good records or field maps so you know where to apply fertilizers.

An adequate soil sample should incorporate soil from 0 to 9 inches deep. Many times, tillage operations bring up soil from deeper in the soil. This can raise the plow layer soil pH if the soil parent material is limestone in nature. Conversely, tillage can bring up more acid subsoil and lower the general field pH, adversely affecting crop performance.

Soil samples should be tested to determine nutrient levels before application of manure, biosolids or commercial fertilizers.

A representative soil sample is essential to obtaining proper fertility recommendations. A soil probe should be used if possible. A soil probe or soil coring device has an opening along one side of the tube so you can observe soil from all sampled depths at once. It also allows one to determine if the pH differs between the top and bottom of the plow layer. Use a Cornell pH kit to sample a pinch of soil from the top and bottom of the soil probe. This is particularly important in no till or reduced tillage system where soil does not get well mixed annually.

Soil testing should form the basis for determining manure-spreading priorities during the off-season. Recommendations from Cornell's Soil Analysis Lab will show where manure should be prioritized. It is pointless to continue to add manure nutrients to fields that already test "high" or above. Top priority fields are those that test "medium" or below for Phosphorus and Potassium.

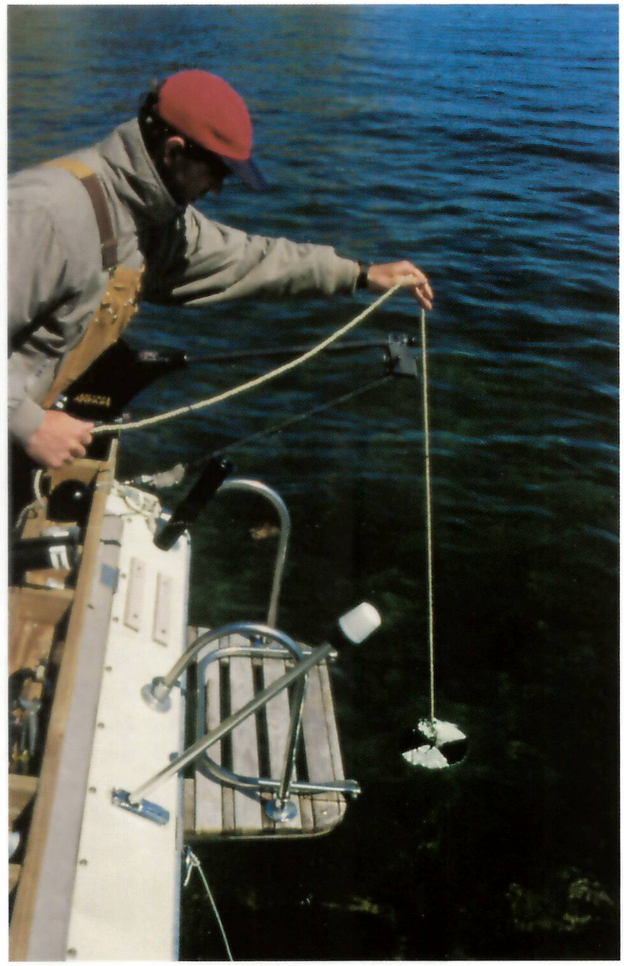
Soil Test Laboratories vary in the extracting solutions they use to assess available nutrients. The Cornell lab uses a mild extracting solution that gives a good estimate of readily available nutrients in the soil. The numbers obtained have been correlated with yield response testing on a wide range of New York soil types. The recommendations are made for maximum economic return while minimizing environmental risk. The recommendations are tailored to soil types and realistic yield estimates. They also give credit to crop rotations, residues and cover crops.

Good stewards of the land do not continue to apply fertilizers just because of past practice. Know what the needs are, know what's available in the soil and on the farm (manure, residues, etc.), and then plan accordingly.

If you have soil test questions, call your local Cornell Cooperative Extension office or call Nate Herendeen, 716-433-2651 or Mike Stanyard, 315-331-8415.

Long-term Limnological Changes in Seneca Lake

By John Halfman, Hobart and William Smith Colleges



Water clarity is measured by lowering the black and white painted disc (Secchi disc) into the water and determining the depth at which it can no longer be seen.

Zebra Mussels (*Dreissena polymorpha*) were first detected in Seneca Lake during the summer of 1992. Within two years they had colonized most of the suitable substrates throughout the lake. Just prior to the arrival of zebra mussels, a field program was initiated through class projects and independent studies at Hobart and William Smith Colleges to investigate the impact of this exotic species on the ecology and limnology of the lake.

A picture of Seneca Lake's limnology was created through periodic observations and analysis of plankton productivity and nutrient concentrations. The amount of plankton was measured using a Secchi disc, a small black and white plastic disc which is lowered into the water until it disappears from view to assess water clarity. (Deeper Secchi disc depths indicate clearer water due to fewer microscopic organisms and/or reduced sediments in the lake.) Lake water was also analyzed for *Chlorophyll-a* concentrations, a plant pigment used in photosynthesis by all aquatic plants. Since zebra mussels filter feed on plankton, they indirectly remove nutrients – specifically nitrates and phosphates – from the ecosystem. That takes these nutrients out of the water until bacterial decomposition of dead zebra mussels or their fecal matter returns these sequestered nutrients back to the water column. The concentrations of these nutrients as well as dissolved silica, which is used by diatoms (the lake's common algae), was also measured.

Significant changes have been observed in the limnological data over the past decade beyond the expected seasonal variability. Two important multiyear trends exist. The first trend starts in 1992 (when reliable data was first collected) and continues through the end of 1997. The second trend starts in 1998 and continues through the end of 1999.

The period from 1992 through 1997 saw an increase in overall water clarity (from Secchi disc data) and a decrease in phytoplankton biomass (from chlorophyll-a data). This change is attributed to increased grazing by the growing population of the filter-feeding exotic mussels. The increased grazing pressure is also consistent with increasing densities of zebra mussels from 1996 to 1998, as seen from sediment dredge samples, and increasing dissolved silica concentrations up through 1997. The increase in dissolved silica is interpreted to reflect the increased consumption of diatoms by zebra mussels: as the zebra mussels reduce the population of diatoms, the uptake of silica by diatoms decreases, allowing more silica to accumulate in the lake. However, nitrate and phosphate data reveal very little change over this time frame, although some data are sparse. Why didn't nitrate and phosphate concentrations increase as the diatom populations dwindled? Perhaps, unlike silica, these nutrients were preferentially sequestered by the growing populations of zebra mussels, and/or these nutrients may have been assimilated by the growing populations of nearshore weeds that do not assimilate dissolved silica. Homeowners have complained of increasing densities of Eurasian milfoil and other nearshore plants.

During 1998, water clarity decreased and phytoplankton biomass increased dramatically. Dissolved silica concentrations decreased to the concentrations detected before 1997. Phosphorus concentrations increased dramatically from 1997 to 1998 and remained high through 1999. These water quality trends run counter to the increased stress on the ecosystem caused by grazing zebra mussels. A number of hypotheses may account for the change.

One: The lake may be becoming more nutrient rich due to an increase in the amounts of nutrients coming into the lake from outside sources like runoff from farms or improper treatment of human waste water. There is minimal evidence to support this hypothesis, however, since land use practices in the watershed have not changed significantly in the last decade. A few farms have recently converted from growing crops to hog farming. However recent water quality monitoring of a number of streams in the watershed indicates little impact on water quality so far from this change in land use.

(LIMNOLOGY, continued on p.16)

Fine-Tuning Your Fertilizer Program For Vegetable Production

By Carol R. MacNeil, CCE Vegetable Specialist
Ontario, Wayne, Yates & Steuben Vegetable Program

Hand-held nitrate meters are used to measure soil nitrate levels in the field and can be a useful tool when deciding how much nitrogen fertilizer to apply.

When is the last time you had your soil tested? Some growers have it done on a regular basis, while others are applying the amount and grade of fertilizer that worked ten years ago. If you're one of the latter, you should know that soils don't stay the same, and your fertilizer program shouldn't either! Soil pH, phosphorus and potassium levels, and organic matter (with its nitrogen-supplying ability) can all change significantly over time.

Eighteen sweet corn, cabbage, potato, onion and organic growers recently participated in a local U.S. Environmental Protection Agency funded project, in cooperation with the SWCD's in Ontario and Yates Counties, to demonstrate the benefits of soil testing and using recommended rates of fertilizer. The results showed that some growers are applying more fertilizer than Cornell research on New York soils would indicate is needed. In other cases growers aren't applying enough of one or more nutrients for particular fields, which can limit yield. Still other growers have been fine-tuning their fertilizer program over the last few years and are right on target.

During the study, soil testing on the participating farms allowed application rates of nitrogen to be reduced on several fields with no decrease in yield or quality. Phosphorus and potash rates were decreased in a few fields, while additional phosphorus was recommended for another field. The results show that some farms could save money on fertilizers by utilizing available soil tests and following Cornell guidelines for fertilizer application rates.

Pre-Sidedress Nitrogen Tests, or PSNTs, originally developed for field corn, have been adapted for use in sweet corn. Two years of trials have shown that growers can confidently use a PSNT to help determine if nitrogen side-dressing is needed. Several local private consultants, fertilizer dealers and growers have purchased Cardy meters (a hand held field nitrogen tester) to perform the PSNT for field and vegetable crops.

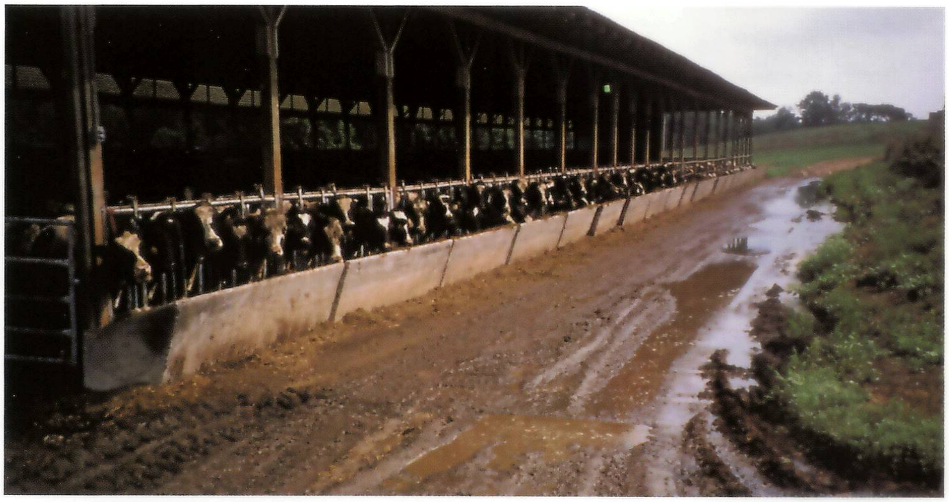
Pre-sidedress nitrogen tests (PSNT) are used to determine how much additional fertilizer is needed to grow crops that demand a large amount of nitrogen, e.g. cabbage.

Consider using the PSNT for sweet corn where:

- Manure has been spread in the past 2-3 years;
- A legume cover crop will be plowed down in the spring or alfalfa has been plowed down in the past 2 years (soybeans don't leave much nitrogen);
- Cabbage, or some other crop where high rates of nitrogen were used, was grown last year; or,
- Compost or some other nitrogen source has been used.

A PSNT result of 25 - 30 ppm or above indicates the soil should be able to supply all the nitrogen the sweet corn will need for the rest of the season, though rainfall and a change in soil moisture can alter the amount of nitrogen available. Research is underway to determine if the PSNT would be useful for other vegetable crops.

If you are interested in complete soil testing or in trying the PSNT, contact the local county Cooperative Extension office, a fertilizer dealer or crop consultant.



Farms with areas of high animal concentrations present increased threats to local waters.

Concentrated Animal Feeding Operations

Barbara Demjanec, SLAP-5

The Clean Water Act (CWA) views animal feeding operations (AFOs) as point sources of pollution. An AFO is defined as a facility where animals are fed and confined for a total of 45 days or more in any period of twelve consecutive months and where crops, vegetation, forage growth or post harvest residue are not included in the facility. The second part of the AFO definition is meant to distinguish "feedlots" from pasture areas, which are not considered point sources under CAFO regulations. Two or more animal feeding operations under common ownership are considered a single AFO if they physically adjoin each other, or if they use a common area or system for the disposal of wastes.

As a point source, AFOs are prohibited from discharging into waters of the United States unless a National Pollutant Discharge Elimination System (NPDES) permit has been obtained (in New York these permits are known as the State Pollution Discharge Elimination System or SPDES). In the past this discharge policy has applied mainly to large-scale feedlots. Smaller operations were treated by the Environmental Protection Agency (EPA) as nonpoint pollution sources. Now, however, the EPA is classifying many of these smaller operations as point sources. EPA estimates that 60% of the nation's surface waters which do not meet Clean Water Act standards today are the result of nonpoint source pollution, with agriculture being the primary contributor (80%). Thus reclassifying smaller farms as point sources will have a significant impact on both water quality and farm operations.

There are several reasons for this: 1) as small farms are designated as CAFOs by the New York State DEC, they become subject to legal action for failure to comply with the terms of the SPDES discharge permit system; 2) farm size is increasing (except in Yates County with its growing number of Mennonite farms); 3) rural non-farm residents are raising concerns over odor, chemical and water quality problems.

There are three tiers in the EPA designation of a CAFO as a point source of pollution.

- All AFOs with 1000 animal units or more are CAFOs.
- AFOs with 300–1000 animal units which discharge pollutants to surface waters either through a man-made ditch, flushing system, or other man made device or directly into the surface waters are CAFOs.
- Finally, any AFO may be designated as CAFO if it is found to be a significant contributor of pollution to surface waters.

In New York State, all CAFOs are required by law to "apply" for a general permit by submitting a Notice of Intent (NOI) to the New York State DEC by January 1, 2000. This notice of intent recognizes current operations in an agricultural business and provides an opportunity for the operator to design, construct and plan for proper handling, storage and discharge of silage leachate, manure, milk center wastewater and barnyard runoff or any other runoff associated with an animal operation.

If an agricultural operation has 1000 or more animal units, a plan for handling waste must be developed within 18 months. Operations with less than 1000 animal units must have a waste plan developed within 24 months. New York State recently required livestock farms with over 300 animal units (210-230 milk cows) to develop and implement comprehensive nutrient management plans (CNMP). Once a CNMP has been created and approved, a permit is issued to the farmer/operator. The permit acknowledges the farmer's stewardship of land and water resources on the farm and allows no discharge of wastewater to surface waters of the state, except in the event of a 25 year, 24 hour storm.

The EPA's goal is to have all livestock farms in the United States implement CNMPs by the year 2009. In 1996 it was estimated that in New York, 1300 AFOs would potentially be required to obtain a permit. Professionals are available to assist with developing plans through county Soil and Water Conservation Districts, Cornell Cooperative Extension offices, USDA Natural Resources Conservation Service (NRCS), and agricultural service consultants. Nutrient management plans must be developed and implemented to NRCS standards. Components of a comprehensive nutrient management plan include feed management, manure handling and storage, manure land application, land management and record keeping. A comprehensive nutrient management plan must be implemented within five years of completion.

(AG. SUMMARY, continued from p.4)

- Most of the field-applied manure was spread seasonally, although slightly less than half of the respondents said they store manure. About one third reported storing silage. Field tile was the most common reported method for milk waste disposal.
- About half of the respondents who had pasture used rotational grazing. Although most farms used more than one drinking water source for pastured animals, water tanks were the largest single source.
- Seven percent of the farms with barnyard/feedlots present were located within 50 feet from a stream, while 67% were located over 200 feet from a stream.
- Thirty-six percent of the 343 respondents indicated having highly erodible land; 32% have ephemeral erosion; 8% had noticed gully erosion on fields.
- Sixty-four percent of respondents reported using pesticides. Herbicides were the most common method used for weed control, followed by cultivation, then crop rotation.
- Sixty percent of those using pesticides used IPM as the method for determining when to use pesticides; 84% of those using pesticides used the label to determine how much pesticide to use.
- The top three conservation practices were crop rotations, subsurface drainage and diversion ditches. Filter strips were the least common best management practice installed in the watershed.
- The average age of farmers in the watershed was 52 years in 1998; the average number of years farming was 26. Despite the age of the farmers, most felt that their operation will be around in 10 and even 25 years.

(LIMNOLOGY, continued from p.13)

Two: The number of zebra mussels could have decreased from 1997 through 1999, reducing stress on the ecosystem. Data from the field programs reveal that the number of zebra mussels collected in sediment dredges has increased 10 times from 1996 to 1998. Yet, sediments recovered in 1999 reveal dead zebra mussels for the first time. And lakeshore property owners have begun to complain about dead zebra mussels' shells littering the shoreline. Perhaps zebra mussels began to die in significant numbers during 1998 due to lack of food or old age.

Three: Natural decomposition of the mussels may have begun to release nutrients back into the water column during 1998 and 1999. The life span of the organism is typically 2 to 9 years. If the mussels took a few years to get established in Seneca Lake, then the first significant die-off would not occur until 2 to 3 years later, or not until 1997 or 1998. Summer lake water temperatures were unusually warm in 1998 and 1999. Warmer temperatures promote a more rapid bacterial recycling of dead organic matter. It is possible that a combination of dying zebra mussels, recycling of the nutrients the zebra mussels previously sequestered and a warmer climate contributed to the observed changes in the lake's limnology through 1998 and 1999.

Seneca Lake has changed considerably after the invasion of zebra mussels. Another more recent exotic species is the Spinier waterflea. Beside its impact on tangling fishing line, it would be interesting to observe what impact this exotic species has on the limnology of the lake in the years to come.

Seneca Lake Watershed AEM is being sent to you courtesy of the Seneca Lake Pure Waters Association and Cornell Cooperative Extension with funding provided by the NYS Environmental Protection Fund.

Seneca Lake Watershed

Agricultural Environmental Management

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The State of the Seneca Lake Watershed 1999

Genesee-Finger Lakes Regional Planning Council

Southern Tier Central Planning and Development Board

CHAPTER 3. WATERSHED DESCRIPTION

THE SETTING

Seneca Lake is the largest of the eleven Finger Lakes that make up a complex system of lakes and rivers in central New York State known as the Oswego River Basin. (*See Figure 3.1*). The Oswego River Basin has an area of 5,100 square miles and drains the hills and valleys of the Finger Lakes into the Oswego River that flows north into Lake Ontario. The Basin encompasses three physiographic provinces (*See Figure 3.2*) which directly affect water flow to and from the Finger Lakes. These include the Appalachian Plateau (the area to the south of the 1,000-foot contour line); Tug Hill Plateau (the circular area to the northeast, within the 1,000-foot contour); and the Lake Ontario Plain (the area south of Lake Ontario). One additional, "unofficial" geographic area is also significant to the drainage pattern of the Basin. This area is the "Clyde/Seneca River-Oneida Lake Trough", a belt of lowlands running west to east within the 500-foot contour. This is the slowest moving, flattest stretch of the Basin into which all of the major rivers, including the Seneca, Oswego and Oneida Rivers, empty.

The elevations of each of the lakes, rivers and the locks along the Barge Canal are shown in Figure 3.3. This diagram illustrates the relationships of the lakes to one another and to their receiving streams and summarizes the cumulative percentages of watershed that drains the Oswego River Basin. The physiography of the basin has created flooding and navigational problems that led to attempts to control lake levels and alleviate flooding.

LAKE LEVEL CONTROL

The first dam on Seneca Lake was built at Waterloo in 1828. That dam, which included four sluice gates, was replaced with the present dam and navigation lock in 1916. Before the 1916 dam was built, the lake level in Seneca Lake fluctuated more and farmers were able to raise truck crops in the wetland area on the south end of the lake, now known as Queen Catharine Marsh. Flooding in the late 1800's lead to the creation of the NYS Water Storage Committee in 1902 whose purpose was to regulate river flow and to develop hydroelectric power sources. According to historical records, the farmers at the south end of the lake were opposed to this regulation since it would raise the lake so that farming would no longer be possible. They did not prevail. The Barge Canal, successor to the Erie Canal, was completed in 1917 and opened to boat traffic in 1918.

Outflow from Seneca Lake now passes through control structures at Waterloo and Seneca Falls. There is a hydroelectric plant at Waterloo and a second one along the Cayuga-Seneca Canal. The level of the lake can be regulated by controls at the outlet or a control further downstream. During the winter the lake is drawn down to prevent ice and wind damage to docks and shore structures and to provide storage for spring runoff. In the summer the lake is stabilized to take into account priority uses of the lake such as boating (so convenient dock heights are considered.) Planned winter lake levels range between 445 plus or minus 0.3 feet. Summer levels are planned for 446.0 plus or minus 0.3 feet. In the 1972 flood, lake levels rose to 450 feet. Flood stage is 448.

Figure 3.1 Location of Seneca Lake as part of the Oswego River Basin.

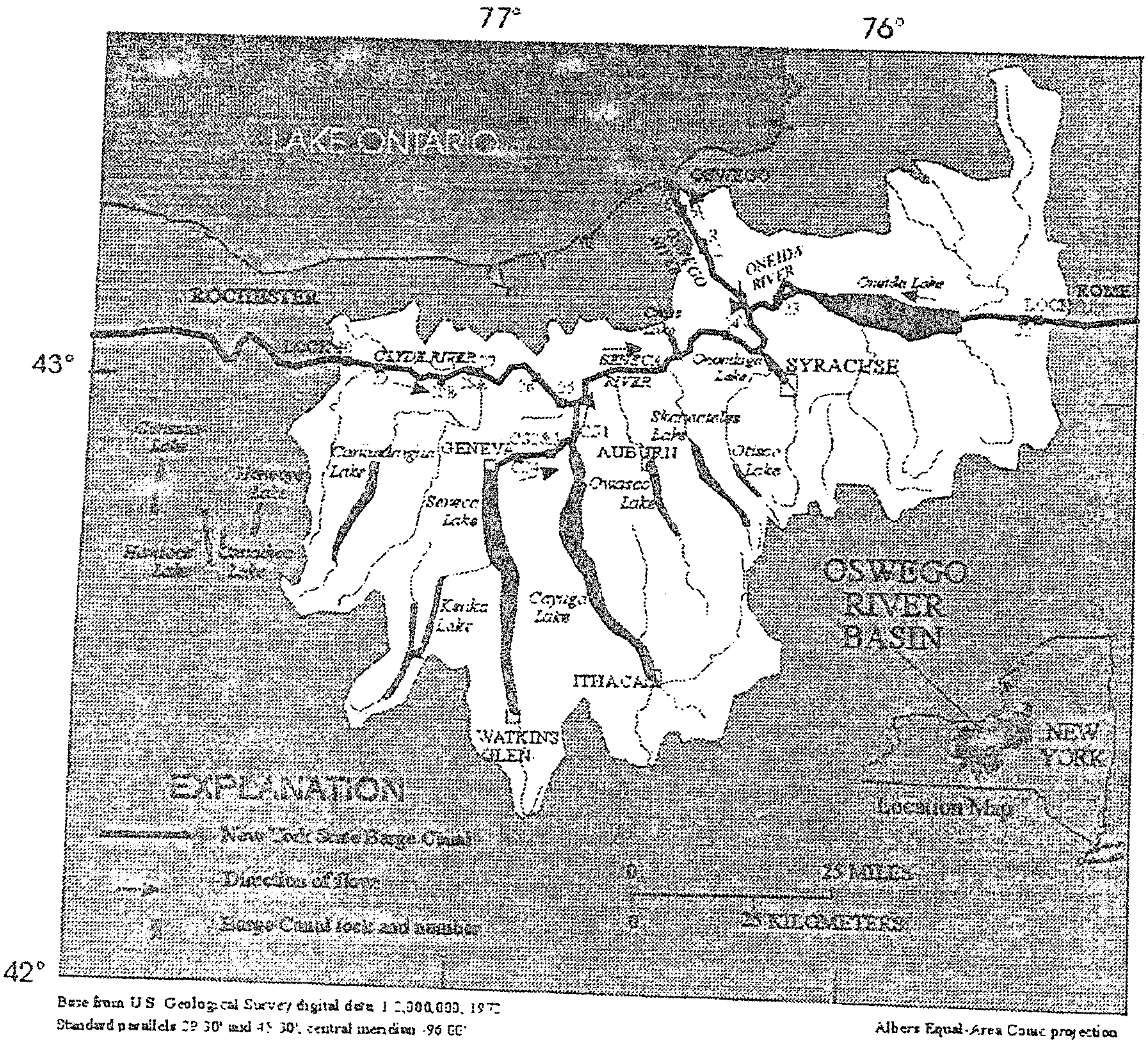


Figure 3.2 Physiographic Regions of the Finger Lakes.

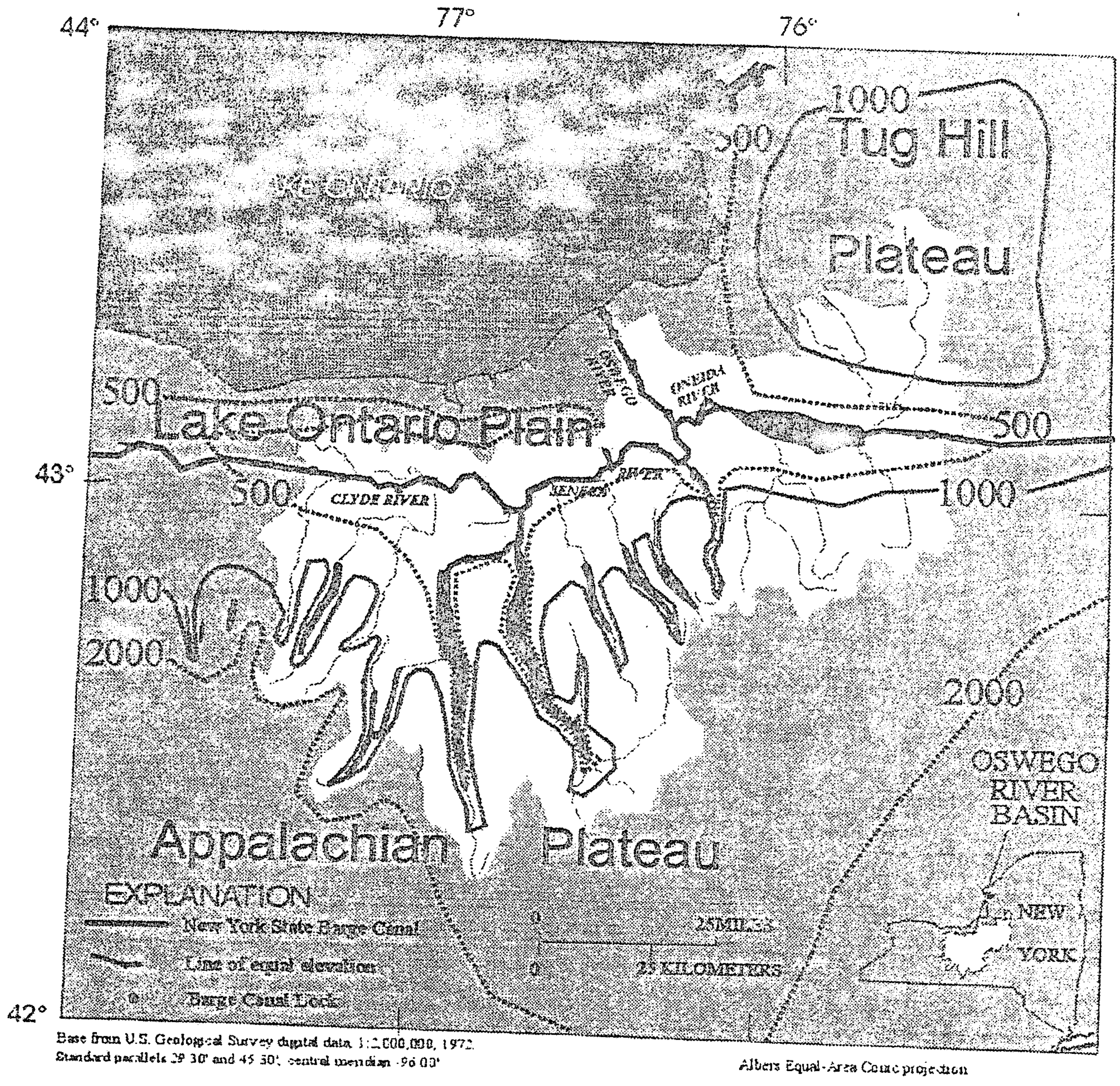
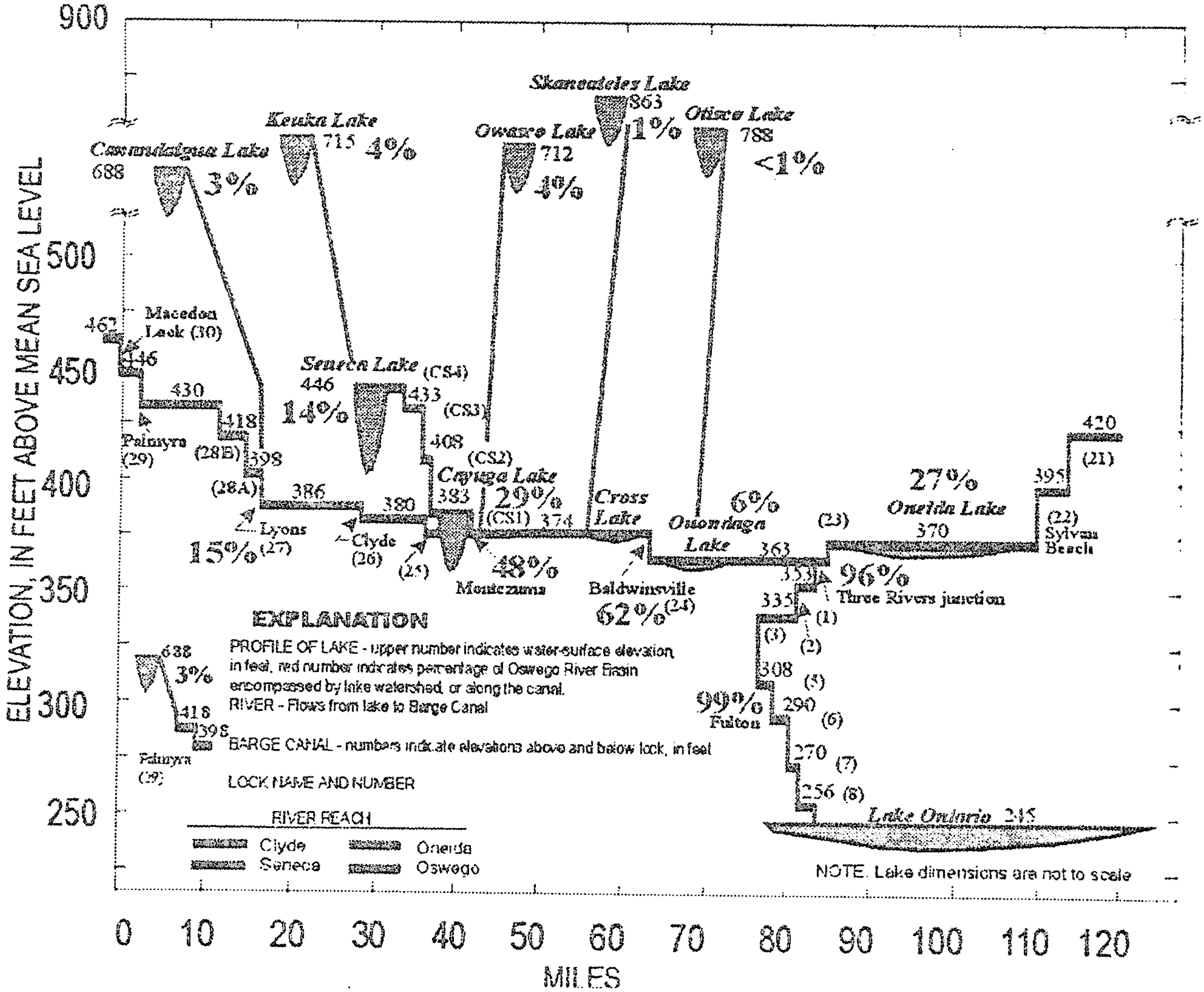


Figure 3.3 Relative Elevations of the Finger Lakes.



LAKE FACTS

Table 3.1 and Figure 3.4 provide instructive information about Seneca Lake in relationship to the other Finger Lakes. Highlights and other interesting facts are listed below:

- Almost 50% of the volume of all the Finger Lakes is stored in Seneca Lake.

- The Lake contains over four thousand billion gallons of water (4.2 trillion).

- There is enough water in Seneca Lake so that, if it were spread over the land to a depth of one (1) foot, it would cover 40% of New York State.

- Land area drained: about 457 square miles

- Dimensions of Seneca Lake:
  35.1 miles long
  3.2 miles at greatest width, 1.9 miles average
  651 feet deep, at maximum (South of Lodi Landing)
  290 feet average depth
  Surface area: 66.3 square miles, 175 square kilometers or about 42,400 acres

- Shoreline in Seneca, Ontario, Yates and Schuyler Counties: about 75 miles

- Hydraulic retention: 18.1 years (*Schaffer and Oglesby, 1978*)

- Age of Seneca Lake: 12,500 years

- pH of Lake water: slightly alkaline, 8.0-9.0, varies with season and depth

- General water clarity - five (5) feet in summer to ten (10) feet in winter (*Halfman, 1999*)

- Sodium Chloride (salt) concentration in lake water: 150 parts per million (ppm) (*Wing et al. 1995*)

The sheer volume of water stored in Seneca Lake is one of this resource's most important value. It:

- represents the ability of a waterbody to hold and dissipate heat and thus modify local climate or serve as a source for cooling water;

- provides for direct human use including drinking, irrigation, and industrial and manufacturing processes;

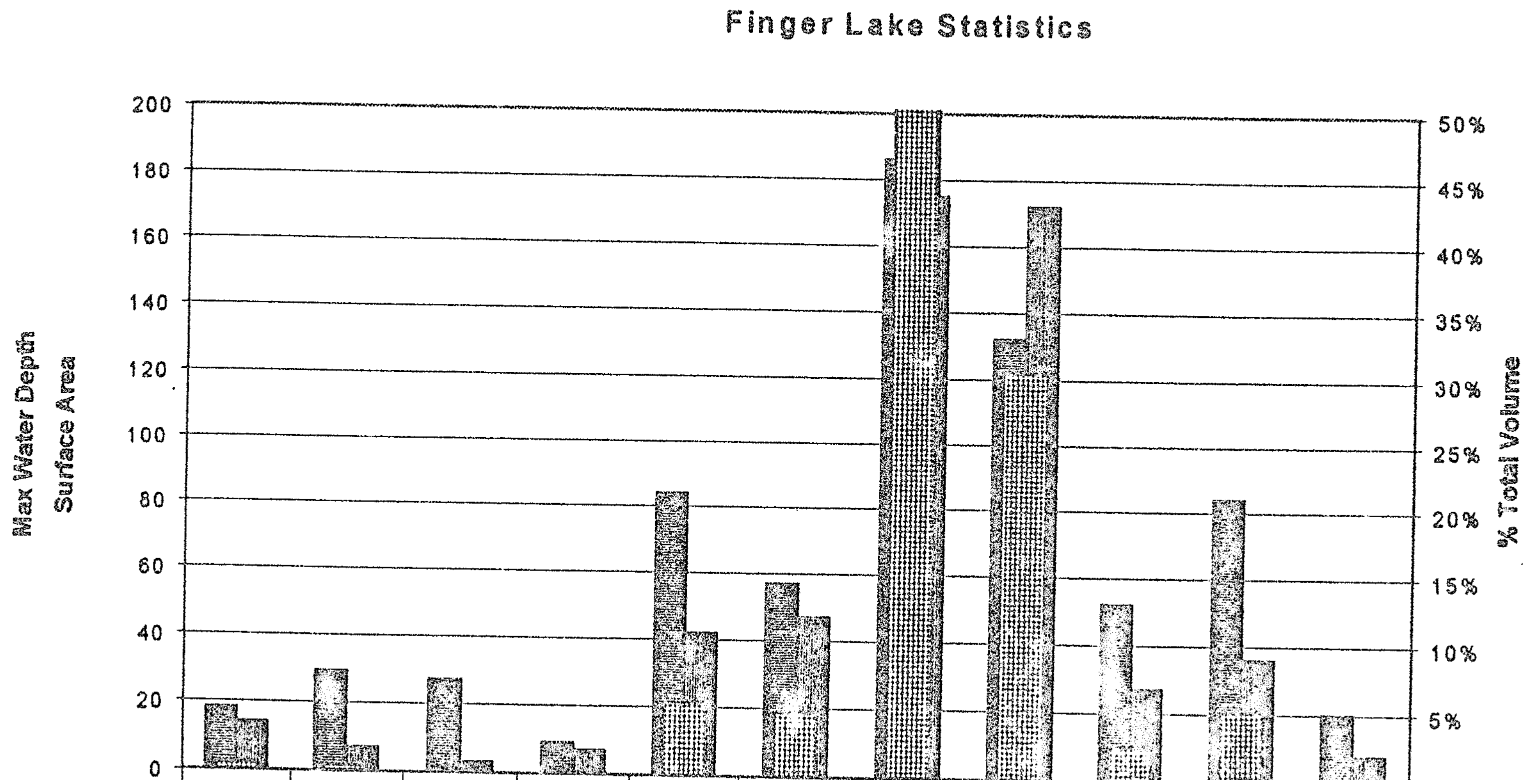
- dilutes and neutralizes of pollutants in the form of sewage effluents, runoff from land, industrial discharges and inputs from individual septic systems; and

– provides for fish production.

Table 3.1 Finger Lake Statistics (from Bloomfield, 1976 and Mullins et al., 1996).

Lake	Length (km)	Max Width (km)	Water Volume ($10^6 m^3$)	Surface Area (km^2)	Drainage Area (km^2)	Max Water Depth (m)	Max Sedimentary Thickness (m)	Mean Depth (Volume/Area)	% Total Volume	Mean Width (km)
Seneca	57	5.2	15,540	175	1,181	186	270	88.8	50.53%	3.1
Conesus	13	1.3	157	14	168	18	na	11.2	0.51%	1.1
Hemlock	11	0.8	106	7	96	29	149	15.1	0.34%	0.6
Canandice	5	0.6	43	3	32	27	68	14.3	0.14%	0.6
Honeoye	7	1.4	35	7	95	9	na	5.0	0.11%	1.0
Canandaigua	25	2.4	1,640	42	407	84	202	39.0	5.33%	1.7
Keuka	32	3.3	1,434	47	405	57	146	30.5	4.66%	1.5
Cayuga	61	5.6	9,379	172	1,870	132	226	54.5	30.49%	2.8
Owasco	18	2.1	781	27	470	52	95	28.9	2.54%	1.5
Skaneateles	24	3.3	1,563	36	154	84	140	43.4	5.08%	1.5
Otisco	9	1.2	78	8	94	20	na	9.8	0.25%	0.9

Figure 3.4 Finger Lakes Statistics.



	Conesus	Hemlock	Canadice	Honeoye	Canandaigua	Keuka	Seneca	Cayuga	Owasco	Skaneateles	Otisco
Max Water Depth (m)	18	29	27	9	84	57	186	132	52	84	20
Surface Area (km2)	14	7	3	7	42	47	175	172	27	36	8
% Total Volume	0.51%	0.34%	0.14%	0.11%	5.33%	4.86%	50.53%	30.49%	2.54%	5.08%	0.25%

Max Water Depth (m) Surface Area (km2) % Total Volume

SUB-WATERSHEDS AND DIRECT DRAINAGE AREAS

The dictionary defines a watershed as "the geological and geographical area of land that contributes water through its springs, seeps, ditches, pools, culverts, marshes, swamps, and streams to a body of water." Seneca Lake's watershed is drained by a number of streams and overland runoff draining (known as "direct drainage") to the Lake. These have been divided among twenty-nine sub-watersheds and direct drainages as noted on Figure 3.5. The Lake's principal tributaries, including Catharine Creek which drains more than one quarter of the watershed, are near its southern end except for Keuka Lake Outlet which enters Seneca on the west shore near the Lake's north-south midpoint. Keuka Lake Outlet drains the Keuka Lake watershed, which is the subject of a separate "state of the watershed" study.

MUNICIPALITIES

Forty communities have at least some portions of their jurisdictions included in the watershed. Five counties, Chemung, Ontario, Schuyler, Seneca, and Yates, cover the watershed. The locations of these municipalities are shown on Figure 3.6.

GEOLOGY

During a time period geologists call the Paleozoic (220,000 - 600,000,000 million years ago) the region now containing Seneca Lake was part of a vast inland sea. Evaporation, precipitation of dissolved minerals and deposition of silt particles produced layers of bottom material of sand, mud, lime and silt. Eventually, these layers were compressed into rocks with a depth of some 8,000 feet. The remnants of this rock, after repeated periods of uplifting and downcutting by erosion are present as today's sandstones and shales of the Hamilton, Genesee, Sonyea, Java, and West Falls formations characterizing the southern part of the basin and the limestones further north.

The great ice age began about 2 million years ago. Twenty massive glaciers invaded the Finger Lakes region. These advances occurred in 100,000 year cycles beginning with a slow glacial advance over 80,000 years, a rapid melt back over 10,000 years, followed by a 10,000 year warm interglacial period as warm or warmer than today's climate. Repeated glacial advances have sequentially dissected the valley of Seneca Lake. A million tourists a year visit the famous gorges around the south end of Seneca Lake. Each gorge is a tangled skein of buried gorges, degraded relic falls, secondary side channels and partially excavated old gorges. The rich gorge diversity is due to multiple glaciers alternately covering gorges and then melting back to excavate debris from old channels or cut new gorges.

SOILS

As glacial ice retreated some 9,000 - 10,000 years ago, surface debris was left behind. In addition to the major moraines (great piles of sand and gravel left where the slowly melting face of a glacier drops the load of material generated by scouring during the glacier's advance) deposits of ground moraine (called glacial till) mantled the region. In the subsequent 10,000 year period these soils have, in many places, been overlaid by and mixed with other material deposited by wind and water and by humus derived from forests that

. Figure 3.5

Seneca Lake Sub-Watershed and Direct Drainage Reference Map

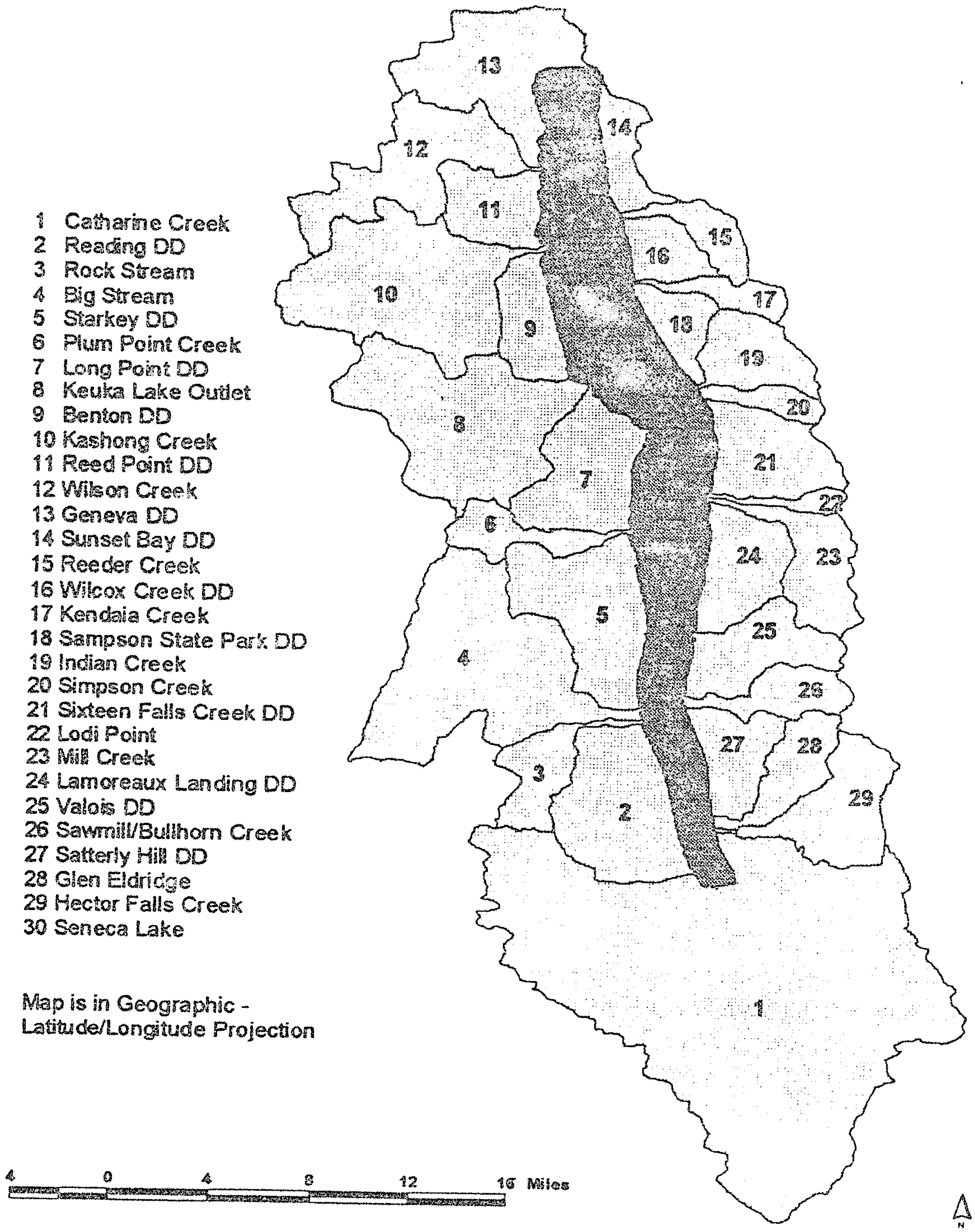
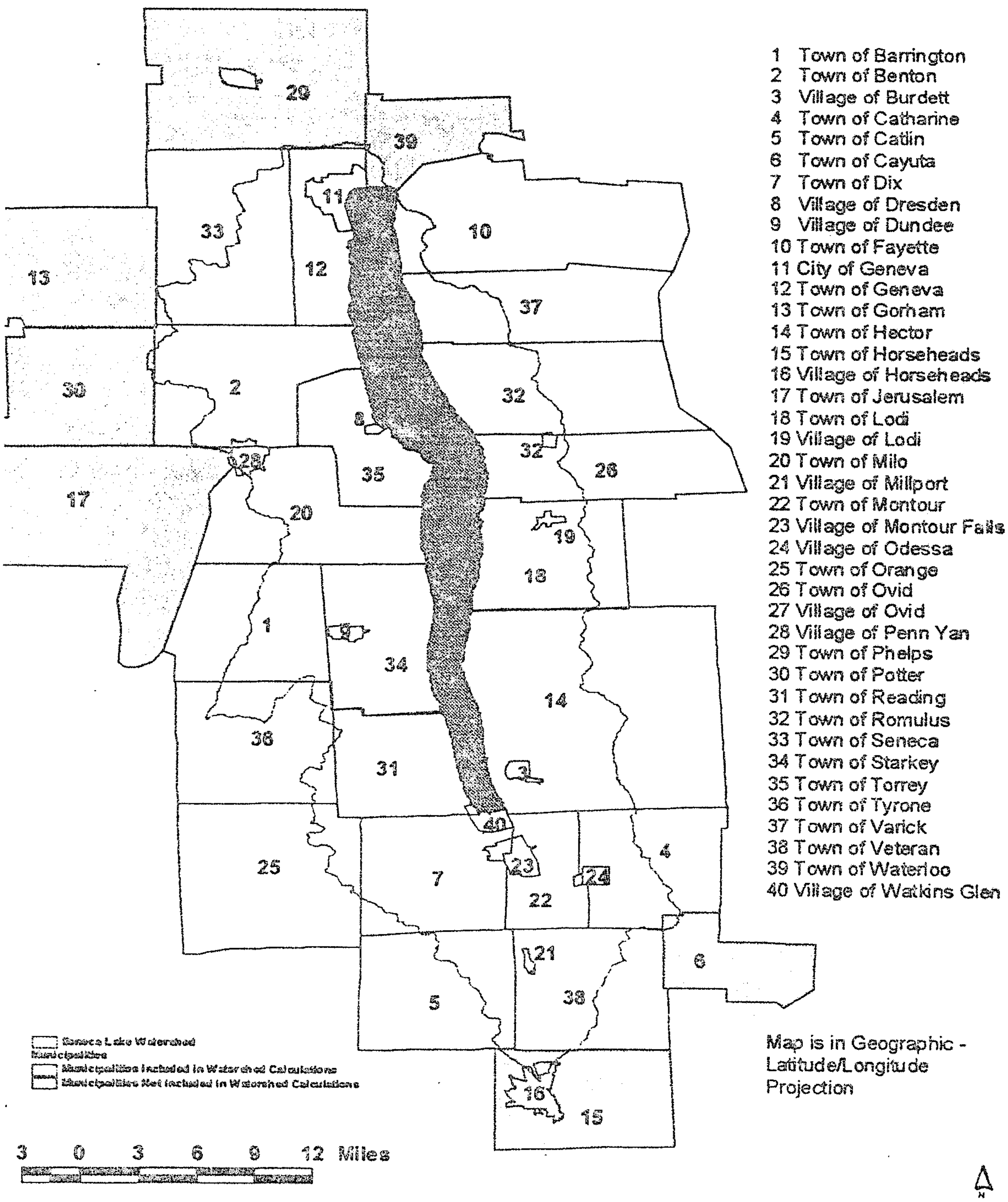


Figure 3.6

Seneca Lake Watershed Municipalities Reference Map



covered the areas. One early (1778) traveler to this region describes the soil's upper layer as composed of 8 to 10 inches of black organic loam. This was undoubtedly a great boon to the earliest agriculturists but one soon lost due to erosion and oxidation.

The northern portions of Seneca Lake's basin contains moderately coarse-textured soil with calcareous substrata. These soils are typically the Howard, Langford, Valois and Honeoy-Lima soils. Southward these give way to complex assemblages of more acid, less well drained types such as Volusia and Mardin-Lordstown. The combination of steeper topography and soils less well suited to many types of agriculture in the south compared with better buffered, better drained soils on less steep topography northwards is strongly reflected in land use patterns and in the price of farmland. (*Detailed soils mapping was prepared as part of this report and is available on the accompanying compact disk.*)

TOPOGRAPHY

Relatively flat topography at the north end of the Lake changes to rolling hills and then steep sided valleys, characteristically extending 900 - 1,000 feet below hill crests, to the south. The most conspicuous landform features are the Lake itself with an elevation of about 445 feet above sea level, and the carved rock channel gorges of east-west tributaries and their associated series of waterfalls. (*See Figure 3.7.*). The Lake has a smooth, regular shoreline. Irregularities that do occur are small and result from flat deltas built by tributary streams and wave action. The surface to bottom slope is steep, averaging nine percent.

CLIMATE

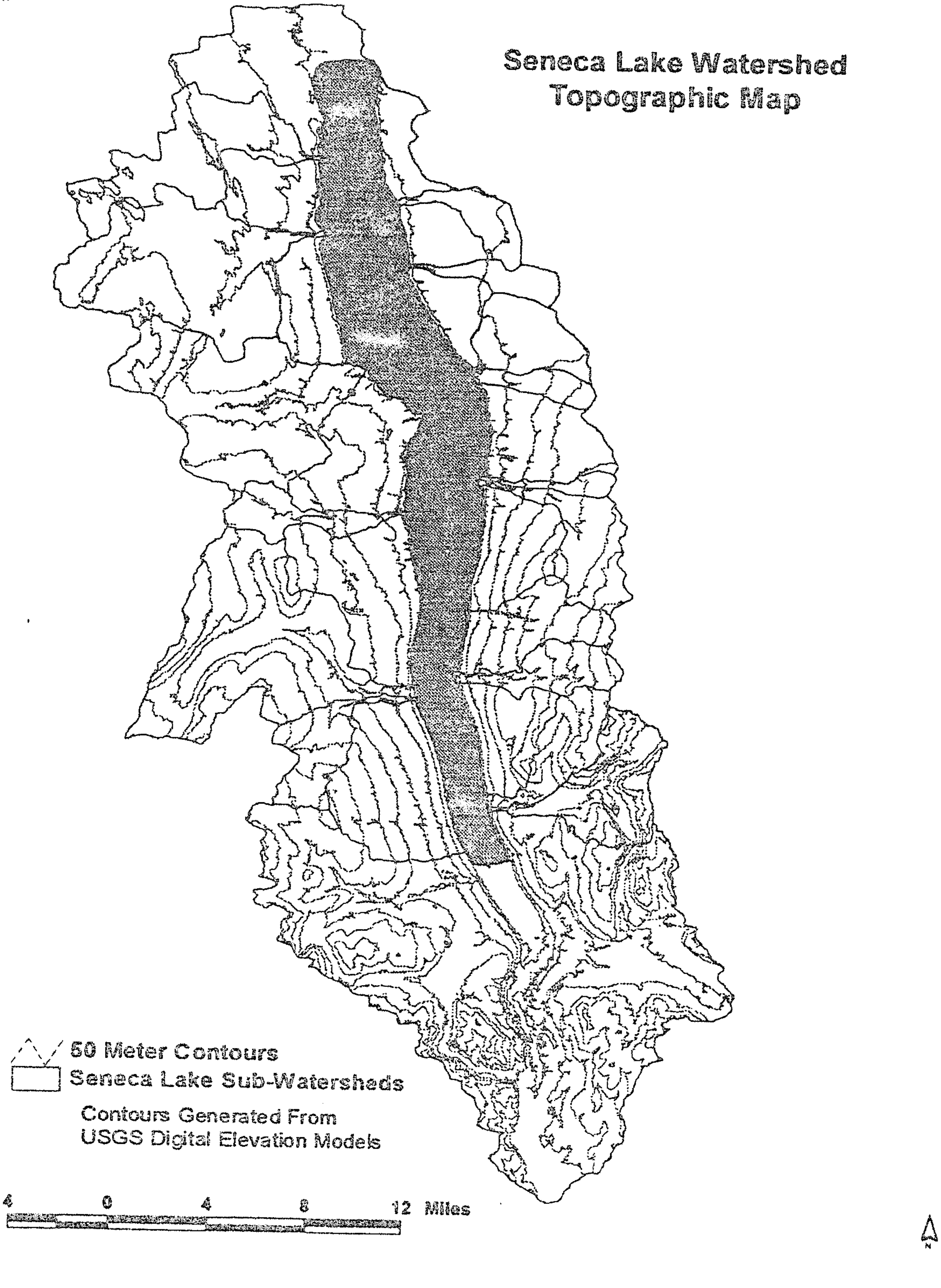
The Finger Lakes climatic region is characterized by cold, snowy winters and warm, dry summers although major flooding events may occur at any time, usually the product of tropical storm remnants entering the region from the south. At the extreme, flooding has been known to raise the Lake level to a maximum of 450.2 feet. As a whole, the central Finger Lakes is one of New York State's driest regions; however, precipitation is adequate to support most horticulture, especially that of deep rooted plants such as grapes.

Average precipitation for the region is about 34 inches per year with the smallest amounts in the December to March period. Winter snowmelt commonly occurs in late March - early April. Air temperature is normally distributed about a July average maximum of 69 degrees Fahrenheit and a 24 degree average minimum in January. From the mid-nineteenth century to early twentieth century local records indicate that Seneca Lake froze over during February-March on four different years. Since 1912, ice cover has apparently occurred only in localized, near shore areas.

VEGETATION

Prior to the American War of Independence, the land in the Seneca Lake basin was covered in virtual entirety by a closed canopy of mixed northern hardwood and softwood trees. Two early travelers through the Finger Lakes region independently described walking for four days without ever being able to observe the sky. Following the massacre and dispersal of

Figure 3.7


Seneca Lake Watershed
Topographic Map
50 Meter Contours
Seneca Lake Sub-Watersheds
Contours Generated From
USGS Digital Elevation Models
4 0 4 8 12 Miles
N

most Native Americans from the region by the U. S. Army Sullivan Expedition in 1779, the area was colonized by settlers from the eastern seaboard who proceeded to convert forests into agricultural land at a rapid pace. Perhaps as much as ninety percent of the land area had been thus converted by the latter half of the nineteenth century. Then began a trend of agricultural abandonment, one that continues today. As a result, much formerly cleared land, especially in the basin's southern portion, has reverted back to forest in various stages of succession.

Four natural vegetative zones are to be found in the Finger Lakes region: the northern hardwoods, elm-red maple-northern hardwoods, oak-northern hardwoods and pine-oak-northern hardwoods. The connotation "northern hardwoods" denotes a large, non-uniform group of trees dominated by beech and sugar maple. Basswood, white ash and black cherry are regular associates in warmer places. Hemlock, white pine and white cedar are abundant but unevenly distributed. Alder and larch are to be found on wet sites; white pine is an early colonizer of abandoned fields. It has been estimated that more than ninety percent of the watershed's forests are mixed northern hardwood and oak with eight percent in softwood plantations. The "idle" agriculture land is in the early stages of succession.

While trees may visually dominate a landscape, smaller understory, groundcover and field plants add vibrant color, unique wildlife habitats and even scent to the natural landscape.

WILDLIFE

Wildlife is abundant and varied in the Seneca Lake basin. Among the most prominent species are the white-tailed deer; Canada goose; a great many kinds of other waterfowl, shorebirds and songbirds; beaver; groundhog; skunk; opossum; gray squirrel; Eastern coyote; red fox; ruffed grouse; muskrat; and cottontail rabbit. Other mammalian species present but much less often seen or heard include the bobcat, black bear, otter, red and flying squirrels, and a variety of mice, voles, and bats. For an index to resident and migratory songbirds the reader is referred to Cornell's world famous Laboratory of Ornithology.

FISHERIES

Traditionally, lake trout, smallmouth bass and yellow perch have been the mainstay of Seneca Lake's fishery. Other species such as rainbow trout, brown trout, landlocked Atlantic salmon, northern pike and largemouth bass add diversity to the fishery. In addition alewives (sawbellies) and rainbow smelt provide a dependable forage base for trout and salmon.

Seneca's excellent fishery has benefited greatly from steady annual stockings of 60,000 lake trout, 65,000 brown trout and 24,000 Atlantic salmon. All other fish species are sustained entirely by natural reproduction. An important factor in the recent resurgence of the Seneca fishery is NYSDEC's ongoing control of the exotic, parasitic sea lamprey. The control program involves applications of the highly selective chemical lampricide TFM to known sea lamprey nursery areas in Catharine Creek and Keuka Lake Outlet at three year intervals. The invasion of other exotic species like zebra mussels and the spiny water flea will not doubt "throw another wrench" into the ecology of the lake and may negatively affect the fishery populations in the future.

RARE AND ENDANGERED SPECIES

The Natural Heritage Program of the New York State Department of Environmental Conservation has provided a list of Rare and Endangered Species which have been or are found in the Seneca Lake watershed. The Natural Heritage Report is included in the Appendix. Note that these lists may be incomplete and should not be used in place of on-site surveys by qualified ecologists.

These species are listed as Rare: Wild Onion (*Allium cernuum*), Kentucky Coffee Tree (*Gymnocladus dioica*), Marsh Horsetail (*Equisetum palustre*), False Hop Hedge (*Carex lupuliformis*), Handsome Sedge (*Carex formosa*), and Rock-cress(*Draba arabisans*).

These species are listed as Endangered: Leedy's Roseroot (*Sedum integrifolium ssp. leedyi*) and Short-eared Owl (*Asio flammeus*).

These species are listed as Threatened: Spreading Globeflower (*Trollius lsxus ssp. laxus*), Northern Wild Comfrey (*Cynoglossum virginianum var. boreale*), Green Floater (*Lasmigona subvirdius*), and Bird's-Eye Primrose (*Primula mistassinica*).

These species are listed as Significant but Unprotected: Slender Pondweed (*Potamogeton filiformis var. alpinus*), Straight-Leaf Pondweed (*Potamogeton strictifolius*), Mare's-Tail (*Hippuris vulgaris*), Blue-Hearts (*Buchnera americana*), Leiberg's Panic Grass (*Panicum leibergii*), Cypress-Knee Sedge (*Carex decomposita*), and Mead's Sedge (*Carex meadii*).

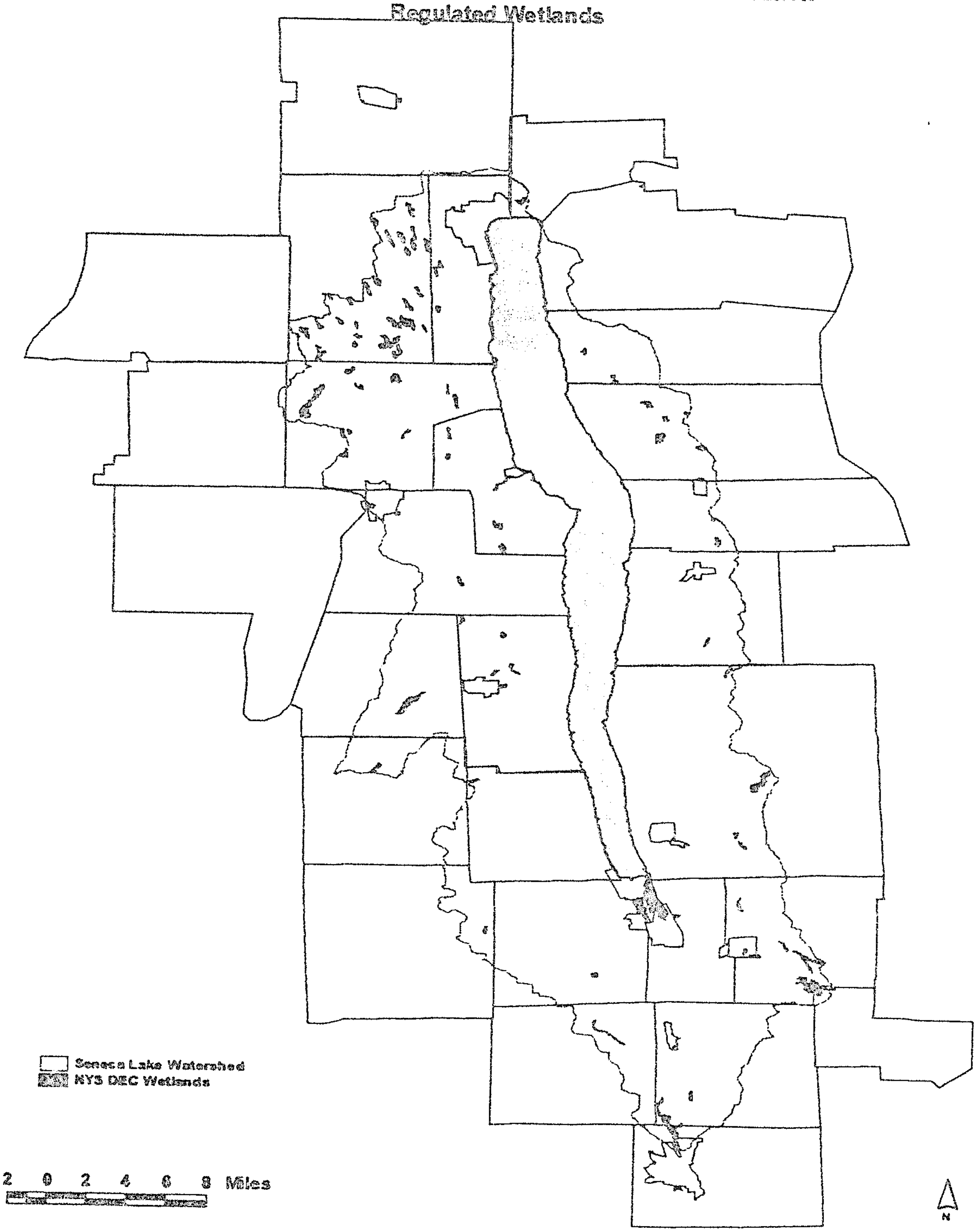
These communities and elements are also listed as Significant but Unprotected: Perched White Swamp Oak Community, Floodplain Forest, Silver Maple-Ash Swamp, and Waterfowl Concentration Area.

WETLANDS

Wetlands form in a great variety of environments. Wetlands include such familiar areas as marshes, swamps and bogs. The presence of water greatly influences the soils and plant life found in wetlands. The water table is usually at or near the surface. The wetland area may be covered by shallow water all or part of the year or may not exhibit surface water.

There are approximately 4,155 acres of New York State Department of Conservation regulated freshwater wetlands in the watershed. (*See Figure 3.8*). These wetlands are fairly evenly dispersed throughout the watershed. In the Seneca Lake Watershed these are wetlands of 12.4 acres or greater in size, or smaller wetlands of unusual local importance. These wetlands have one or more of the following characteristics: a) lands and submerged

Seneca Lake Watershed
New York State Department of Environmental Conservation
Regulated Wetlands



lands commonly called marshes, swamps, sloughs, bogs, and flats supporting aquatic or semi-aquatic vegetation which depend upon seasonal or permanent flooding or sufficiently water logged soils to give them a competitive advantage; b) land and submerged lands containing remnants of any vegetation that is not aquatic or semi-aquatic that has died because of wet conditions over a sufficiently long period, provided that such wet conditions do not exceed a maximum seasonal water depth of six feet and provided further that such condition can be expected to persist indefinitely, barring human intervention; or c) land and water substantially enclosed by aquatic or semi-aquatic vegetation.

AGRICULTURE

The first colonists to enter the area in 1788-89 were seeking land to farm. In the early years (1790 to 1820), the area was properly considered a "Wild West" in which pioneer colonists led isolated and largely self-sufficient lives on the frontier. Economic activities were curtailed by a lack of cash and an inability to transport goods to market. After the opening of the Erie Canal, building of railroad lines and improvement of transport (steamboats on the lake, automobiles on land) and roads, farmers and merchants were able to trade more easily and participate in coastal markets.

Seneca Lake watershed lands were increasingly used for agricultural purposes, due to its relatively mild climate and fertile soils. During the Civil War, markets for commodities produced in this area were particularly lucrative. By 1885, about 85% of the land had been cleared for farm tillage and pastures. After the 1840s, however, better land to the west attracted farmers, and soon western production and markets predominated. In the Seneca Lake watershed, grape growing, beginning in the 1860's, kept land in production. Grape growing was hurt by Prohibition, and all agricultural activity was hit hard by the Great Depression. From 1930 to 1940, farmers left the land in record numbers; only the advent of World War II brought improvements in agricultural earnings.

Until recently, most of the industries which located in the Seneca Lake watershed were related to agricultural processing: canneries, fruit-drying, milk processing, cheese making, and basketry. Agricultural land use declined between the 1950's and the 70's. Fewer, older farmers each worked more land, but the net amount of agricultural land declined. Only in recent years has this trend been reversed with the influx of younger Mennonite farmers working more cooperatively on smaller individual acreages. In a similar trend, competitive markets for grapes were reduced by the loss of independent wineries in the 1960's and 70's, and many grape-growers ceased production. A resurgence of small, farm-based wineries and developing specialty markets in the 1980's has kept growers in business.

RECREATION

Boating is an important recreational use of the Lake. The New York State Canal Recreationway Plan, published in the mid 1990's, documented about 60,000 boat registrations in the Central New York area which includes the Finger Lakes region (Ontario

(www.gflrpc.org)

Seneca Lake Watershed

The Watershed

The Seneca Lake Watershed covers portions of Chemung, Schuyler, Yates, Ontario, and Seneca Counties. Agriculture and tourism are among the major industries in the watershed and are closely linked with its environmental quality. The general land uses in the watershed are agriculture, pasture, forest, brush, rural and urban residential (largely on septic systems), and commercial/industrial.

The watershed is drained by approximately 130 year round tributaries which, along with the groundwater flow, account for most of the point and nonpoint source pollutants into Seneca Lake. The tributaries account for a heavy sediment load into the lake, which among other things, tends to put stress on fisheries. The lake is the source of drinking water for 62,000 people. Flooding is a major problem on Seneca Lake. It effects large portions of the shoreline on an annual basis. The lake is the focal point for much of the recreational and tourism activities in the watershed including fishing and boating. Therefore, the economic

Seneca Lake Watershed QuickFacts

- Seneca Lake is the Largest of the Finger Lakes.
- Drainage area: 707 Square Miles. Surface area: 67.7 Square Miles.
- Seneca Lake Watershed Includes Portions of Seneca, Yates, Schuyler,Steuben, and Chemung Counties.
- Shoreline in Seneca, Ontario, Yates, and Schuyler Counties: 75.4 miles.
- Hydraulic retention: 18.1 years.
- Age of Seneca Lake 12,500 years.
- pH of Lake water: 8.0-9.0 varies with season and depth.
- Sodium Chloride (salt) concentration in Lake water: 170 parts per million (ppm).
- Bedrock of Seneca Lake Basin: sedimentary shales and siltstones of the Hamilton, Genesee,Sonyea, Java and West Falls formations, from Middle to Upper Devonian (365 million years old).
- Precipitation on the Watershed: 32-36 inches per year,
  1/3 as snow,2/3 as rain, most in late spring and early summer.
- Elevation of Lake: 445.5 feet above sea level.
- Estimated population of watershed - 60,000+.

viability of the watershed is directly dependant on the water quality of the lake. This includes the tourism industry itself as well as the value of lakeshore property. The economic viability, however, must be balanced with the health of the lake.

Due to the large size of the lake it is imperative to develop a plan that sustains the high water quality that the lake presently has before it develops eutrophic characteristics.

The quality of the lake, groundwater and streams depend on the activities in the watershed. The Seneca Lake Watershed covers portions of Chemung, Schuyler, Yates, Ontario, and Seneca Counties. Agriculture and tourism are among the major industries in the watershed and are closely linked with its environmental quality. Tourist attractions include the many wineries in the region, villages and urban areas, as well as the recreational value of the lake itself. Seneca Lake is rated as an excellent

- Land Use in Watershed:
  - 35% cropland
  - 45% woodland
  - 15% inactive agriculture and other
  - 3% residential
- Forest Type: 90% mixed nothern hardwood and oak, 8% softwood plantations, much land in early stages of succession.
- Lake water uses: City of Geneva, Waterloo, and Village of Watkins Glen withdraw drinking water for 70,000+ persons.
- Lake level and flow through outlet are regulated by gates operated by NYSEG and NYS Thruway Authority.
- Recreational uses: Tourism expenditures in the counties surrounding Seneca Lake exceeded $100,000,000. The lake is a major attraction. Tourism employs 80,000 in the Finger Lakes area. Major attractions:Watkins Glen State Park, Seneca Lake State Park at Geneva, Sampson State Park.
- Permitted discharges to the Seneca Lake watershed: Sewage Treatment Plant (STP) City of Geneva, STP Village of Watkins Glen, STP Village Montour Falls, NYSEG Greenidge Power Plant at Dresden, CargillSalt Co., AKZO Salt Co., STP Seneca Army Depot, Seneca FoodsCorp.-Libby Plant, STP Village of Penn Yan, STP Village of Dundee,Transelco Div. of Ferro, NYSEG Lockwood Ash Disposal Site,Watkins Glen International.
- Common game fish of Seneca Lake: Northern pike, Rainbow trout, Brown trout,

lake for fishing, and is particularly known for lake trout. Initial work on the Seneca Lake Watershed Project has delineated the watershed at the Keuka Lake Outlet. Thus most of the Village of Penn Yan lies in the Seneca Lake

Watershed. The only city in the watershed is Geneva which is situated on the north end of the Lake. On the south end of the Lake is the Village of Watkins Glen.

bass, Chain pickerel, Salmon.

- Fish stocked in Seneca Lake: Lake trout, Brown trout (about 60,000 per year).
- Major wetlands associated with Seneca Lake: Queen Catherine's Marsh, 800+ acres between Watkins Glen and Montour Falls.

Seneca Lake Subwatersheds

Watershed Name	Acres	Square Miles	Tributary Miles
Geneva Drainage (incomplete)	14527.0	22.7687	25.28
Sunset Bay Drainage	4827.1	7.5423	1.91
Seneca Lake	46170.3	72.1411	---
Wilson Creek Subwatershed	12216.1	19.0876	23.19
Reed Point Drainage	5901.2	9.2206	9.96
Kashong Creek Subwatershed	20903.8	32.6621	36.98
Reeder Creek Subwatershed	3189.8	4.9840	6.81
Wilcox Creek Drainage	3828.0	5.9813	4.56
Benton Drainage	5678.6	8.8728	8.04
Kendaia Subwatershed	2543.5	3.9742	4.54
Sampson State Park Drainage	3784.3	5.9130	2.72
Indian Creek Subwatershed	5909.2	9.2331	12.06
Keuka Lake Outlet Subwatershed	21133.0	33.0203	44.49
Simpson Creek Subwatershed	2290.8	3.5794	4.27
Long Point Drainage	10025.9	15.6655	28.37
Sixteen Falls Creek Drainage	8255.2	12.8987	16.68
Lodi Point Watershed	985.8	1.5402	2.38

Mill Creek Subwatershed	7030.6	10.9854	13.26

Plum Point Subwatershed	3969.0	6.2015	9.87
Lamoreaux Landing Drainage	6953.2	10.8644	22.17
Starkey Drainage	13007.1	20.3235	27.37
Big Stream Subwatershed	25337.3	39.5896	49.96
Valois Drainage	7526.2	11.7598	23.64
Sawmill/Bullhorn Creek Subwatershed	4588.5	7.1695	14.98
Satterly Hill Drainage	5845.7	9.1339	18.70
Glen Eldridge Subwatershed	5395.6	8.4307	13.88
Reading Drainage	13440.2	21.0003	57.78
Rock Stream Subwatershed	4965.0	7.7578	11.32
Hector Falls Creek Subwatershed	8735.3	13.6489	21.62
Catharine Creek Subwatershed	87332.9	136.4577	208.66

See Also... Seneca Lake Watershed Total Road Miles By County, Watershed and Municipality

The following Municipalities are either all or partially in the Seneca Lake Watershed:

Ontario County

- City of Geneva
- Town of Geneva
- Town of Seneca

Seneca County

- Town of Fayette
- Town of Varick
- Town of Romulus
- Town of Ovid
- Town of Lodi
- Town of Waterloo
- Village of Willard
- Village of Ovid
- Village of Lodi

Chemung County

- Town of Veteran
- Town of Catlin
- Town of Horseheads
- Village of Millport
- Hamlet of Pine Valley

Yates County

- Town of Benton
- Town of Torrey
- Town of Milo
- Town of Barrington
- Town of Starkey
- Village of Dundee
- Hamlet of Himrod
- Hamlet of Bellona
- Hamlet of Benton Center

Schuyler County

- Town of Reading
- Town of Tyrone
- Town of Orange
- Town of Dix
- Town of Montour
- Town of Catharine
- Town of Hector
- Village of Montour Falls
- Village of Watkins Glen
- Village of Burdett
- Village of Odessa
- Hamlet of Reading Center
- Hamlet of Rock Stream
- Hamlet of Valois
- Hamlet of Logan

The critical situation facing the health of America's water resources and aquatic ecosystems is not the result of a single activity on or near a lake, river, or stream. Instead it is the combined and cumulative result of many individual activities throughout a waterbody's entire natural drainage area, or watershed.

Seneca Lake Watershed has many individual (but interrelated) activities. Unfortunately most people do not understand the interrelationships and the dire results of their actions. Much of this is due to the limited watershed data available. Sound decisions are based on good information.

Partly because of this lack of information and the ensuing education, most municipalities in the watershed lack good water quality land use regulations and controls and/or enforcement of those regulations. Many of the municipalities in the watershed have gone as far as instituting moratoriums on planning. In a recent survey conducted by Seneca Lake Pure Waters Association (SLPWA), 49 percent of respondents stated that local ordinances to protect the lake should be stricter. The lake suffers the consequences of unregulated and unplanned potential contaminants such as inactive hazardous waste sites, septic systems, SPEDES permits, abandoned landfills, hazardous waste sites/spills, waste disposal, streambank erosion, pathogens, salt storage/use along with unplanned residential, industrial and agricultural uses. The SLPWA survey found that 43 percent of the respondents stated that the greatest threat to Seneca Lake is pollution, development, farm runoff, and septic systems.

The watershed is drained by approximately 130 year round tributaries which along with the groundwater flow accounts for most of the point and nonpoint source pollutants into Seneca Lake. The tributaries account for a heavy sediment load into the lake, which among other things tend to put stress on fisheries. The lake is also the source of drinking water for 62,000 people who will need to have good information so that they can ultimately retro-fit most systems for treatment and filtering. Flooding is a major problem on Seneca Lake. It effects large portions of the shoreline on an annual basis.

The lake is the focal point for much of the recreational and tourism activities in the watershed including fishing and boating. Therefore, the economic viability of the watershed is directly dependant on the water quality of the lake. This includes the tourism industry itself as well as the value of lakeshore property. In a recent survey compiled by SLPWA, 66 percent of the respondents agreed that the water quality of Seneca Lake affects the value of lakeshore property. The economic viability, however, must be balanced with the health of the lake. Presently boating noise, wake erosion and lack of pump-out stations (8 on the entire lake), threaten water quality. Because Seneca Lake is considered an intercoastal waterway, boats are allowed to discharge with little treatment.

On the NYSDEC 1995 Priority Water Problem List Seneca Lake is classified as A. The use impairments listed are water supply stressed and fish propagation-threatened. The primary pollutant is listed as salts. The primary source of contamination is listed as industrial. Resolvability condition needs verification.

Due to the large size of the lake it is imperative to develop a plan that sustains the high water quality that the lake presently has before it develops eutrophic characteristics. The unique feature of Seneca Lake is that it is oxygen-rich and nutrient-poor. Without adequate safeguards and planning the lake will degrade with little hope of reversal. This scenario is now happening in Otsego Lake, which has similar characteristics to Seneca Lake. It is about to lose its lake trout population and oxygenated year-round status due to many years of nutrient loading.

For more information about the Genesee/Finger Lakes Regional Planning Council contact us at;

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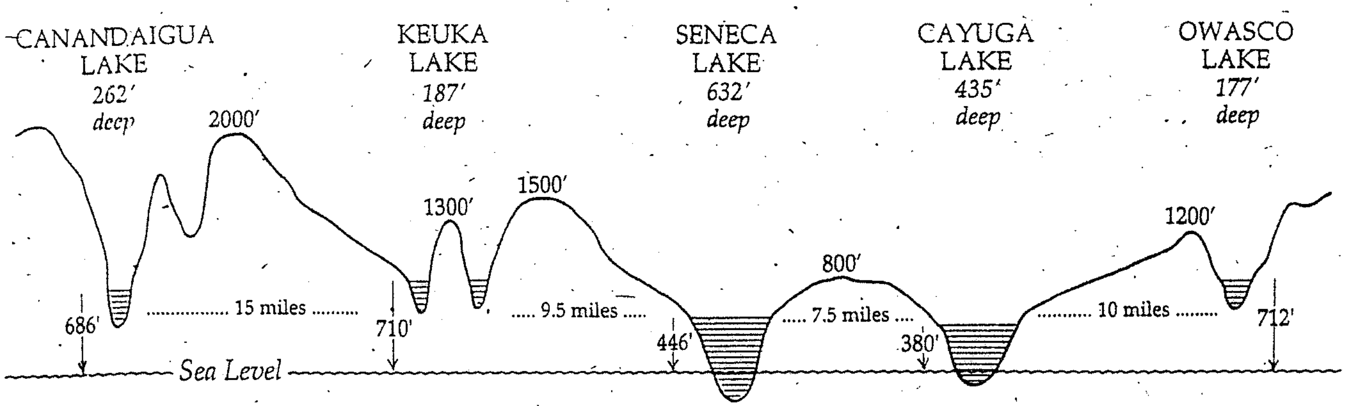
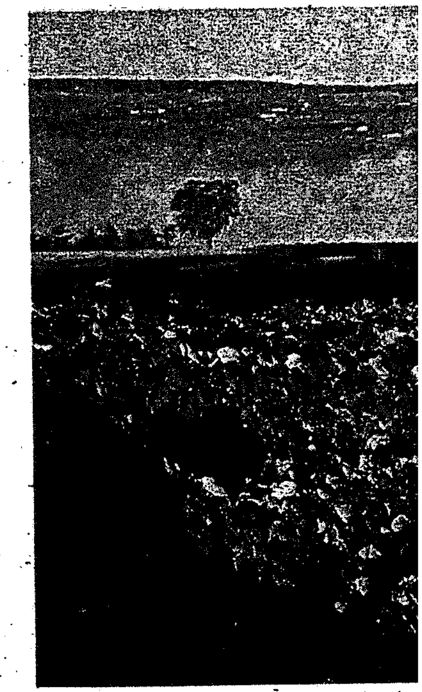
plugging the ancient river valleys. As the ice sheets melted back, water filled the chasms to form a series of narrow, parralel lakes.

The Finger Lakes are extraordinarily deep. The bottoms of Seneca and Cayuga drop well below sea level. Narrow slices of water with relatively little surface area, they tend to maintain a stable temperature throughout the year. Surface water temperatures do shift with the seasons, but at a depth of 200 feet, for example, the water temperature of Seneca Lake stays 37° F. year-round. This causes the lake to act as a collosal radiator in the winter months. Seneca and Cayuga Lakes have frozen over, briefly, only a few times during each of the last two centuries. They remain open water, radiating heat, even as the nearby Great Lakes freeze.

Not only do the lakes take the edge off frigid upstate winters, often keeping vineyards 10-15° warmer than locations just a half mile away, but they also cushion the transitions of spring and fall. On the first hot days of April and May, the cooling influence of nearby water tends to delay the emergence of tender new vine shoots until the risk of damaging spring frosts has passed. In fall the effect reverses: summer heat stored in the surface layers of the lakes radiates up to ripening grapes, postponing first frosts until as late as November.

Distinct microclimates along the hillsides rising from the lakeshores make it possible to reliably ripen grapes in a region that is generally too cold for viticulture and certainly too cold for delicate European vines like Chardonnay and Pinot Noir.





The way in which the lakes wa
vineyards becomes graphicall
clear fall morning, when dens
the lakes. Heat rising from the
in the valley by cold air above
the warmer air forms a cloud
warm breath becomes visible
difference in air temperature
the foreground of this picture

Slim fingers beckon

by

ARCH MERRILL

THE beckoning fingers are those of ten lakes, those long and slender stripes of blue in the middle of the New York State map. This is Arch Merrill's tenth regional book. His second, "The Lakes Country," came out in 1944. It covered the Finger Lakes in the Rochester area, Seneca, Keuka and Canandaigua, and their four smaller upland sisters, Conesus, Hemlock, Canadice and Honeoye. "The Lakes Country" proved so popular that, despite repeated printings, it was out of print in five years.

This 1951 book is the first one published which covers the entire Finger Lakes country. It retains all the flavor of the earlier book with much new material added. Chapters have been added on the eastern Finger Lakes, Skaneateles, Owasco and Cayuga, all rich in scenic beauty, history and lore.

Arch Merrill believes that lakes and cities and villages have distinct personalities just as people do. In SLIM FINGERS BECKON he has caught the spirit of the lakes and the communities upon their shores.

You will want to read about the teasel harvest at Skaneateles, about Auburn's "Copper John," about the original Bloomer Girl at Seneca Falls. Cornellians will relish the chapter on "Town and Gown." The old Indian legends live again—the Lake Guns, the Spirit Boatman, the Curse of Keuka and the Serpent of Bare Hill and others. These are skillful profiles of the cities of the Finger Lakes, Auburn, Ithaca, Geneva and Canandaigua, besides scores of smaller communities. Here for the first time is the WHOLE STORY of the Finger Lakes country, a romantic and historic land.

$2.75

Chapter 6

Seneca

LAKE OF THE HIDDEN GUNS

Seneca Lake is a lovely vixen.

Centuries ago the Red Men became enamored of its 36 miles of cold and shining water. They gave her the name of the mightiest nation of their confederacy. They made her wooded slopes where falling waters tinkled in the glens their happy hunting ground. But they never trusted her.

Seneca was not like her sister lakes. She seemed to be bottomless. She seldom was frozen over even in the coldest weather. She was given to gusts of temper and sudden tides that drove the war canoes on the rocks.

But she could be so charming when she smiled that the Red Men forgave her tantrums and her guile. And they held her in deepest awe, for supernatural voices spoke from her spring-fed depths—with the dull rumble of hidden guns.

The Senecas came to know other and more terrible guns along the lake—the cannon and flintlocks of Sullivan's men. After the invaders left, the Indian villages were wind-blown ashes, the crops were blackened embers, the orchards twisted ruin. In the War of the Revolution the Keepers of the Western Door lost their homeland forever.

Then Seneca Lake became a pathway of white man's empire. From 1788 until well into the 1830s a great tide of mi-

gration surged along the lake. Canals were dug to link the lakes and rivers and the products of the frontier flowed through a chain of inland waterways. The era of the canals passed. The railroads came and then the automobile to shove the picturesque old steamboats into oblivion.

Some once lively ports became drowsy hamlets. Geneva, at the foot of the lake, grew into a flourishing and distinctive city, the seat of two colleges. Watkins Glen at its head, with its wealth of natural splendor, became a mecca for tourists and a noted health resort. In between, the fecund countryside along its shores and on the ridges between the lakes lapsed into pleasant slumber.

Then the war drums sounded for the greatest conflict of all time, the second World War, and Seneca's quiet eastern shore awoke to find itself no longer a serene strip of farms and villages and summer cottages but the heart of a vast military reservation.

The old hamlet of Kendaia was blotted out and in its stead rose a huge munitions depot. To the north the lights of Sampson, a city of sprawling barracks, the second largest naval training station in America, housing 45,000 bluejackets, glittered in the sky.

Peace came and Seneca Ordnance Depot was retained. The naval station was abandoned and Sampson, after serving as a naval hospital, a commodities depot and a state college for GIs and rapidly falling into disrepair, was about to be converted into a state park when the Korean outbreak called it back into service—this time as an Air Force training base.

Again the impact of a faraway war struck the Seneca Lake

Hey, what's that thing out in the middle of the lake?

Story by CHARLES ROBINSON
Photos by SETH SIDITSKY
Finger Lakes Times

DRESDEN — Since its arrival in 1960, the Navy barge on Seneca Lake has been a source of curiosity and speculation for area residents.

Tales of nuclear testing and storage, searches for the bottom of Seneca Lake and storage of highly classified spy information are among its rumored uses.

Mark Hammond, Seneca Lake program manager for the Naval Undersea Warfare Center in Newport, R.I., said he has even heard suggestions that a Russian submarine is hidden in the water deep below the barge.

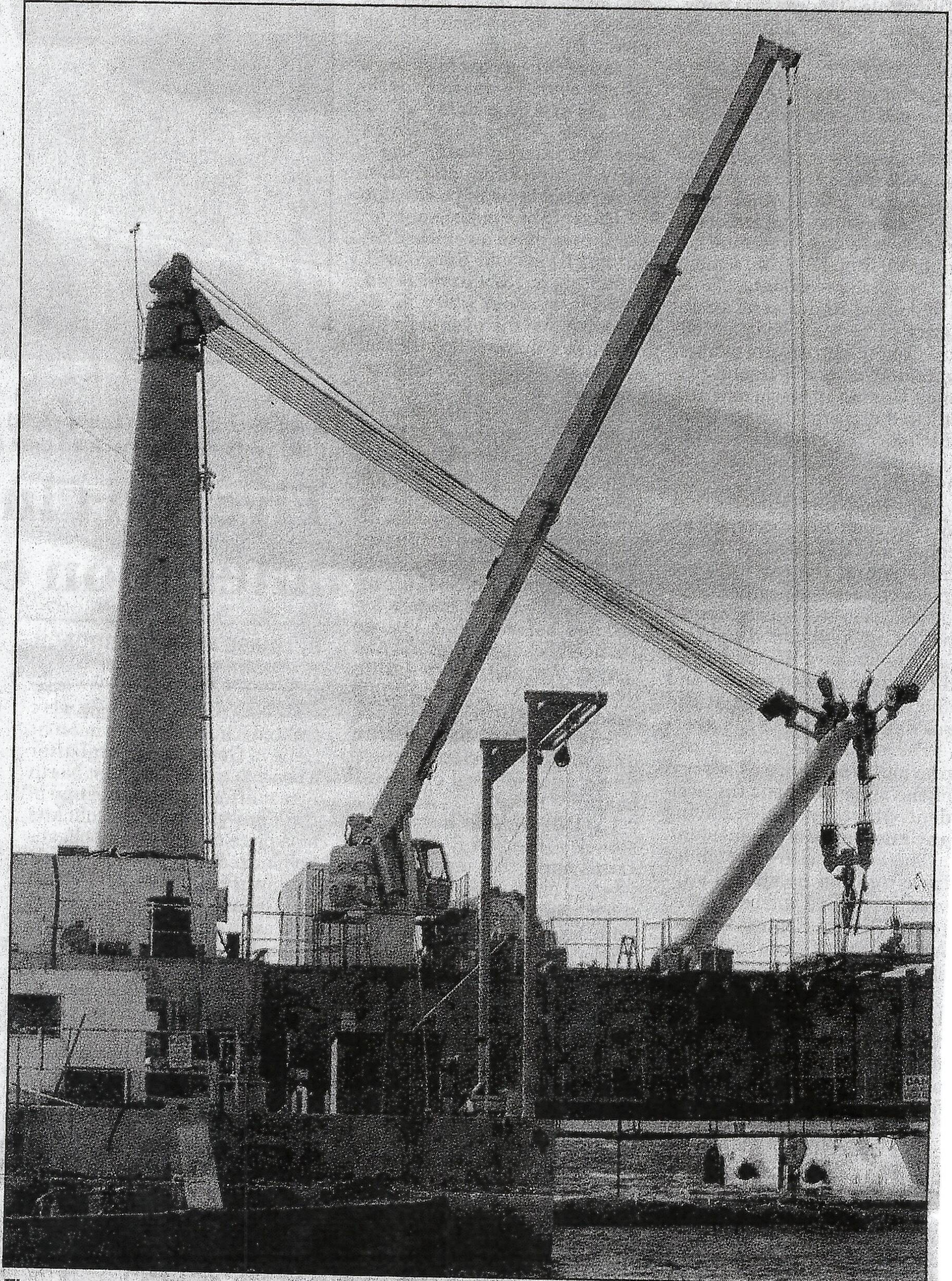
Hammond acknowledges that much of the speculation stems from the fact that the barge is a government facility and also because of security measures necessary to keep people out of the facility's shore site and off the barge.

"People see that the area is fenced in. It's a government facility and that gives the impression that something secret is going on," Hammond said. "The fact is that we're responsible for everyone that comes here."

The barge is, in fact, a test site — for sonar. It's not exact-y nuclear testing but it is sensitive enough that not just any-one can walk through the gates of the barge, which is officially known as the Seneca Lake Sonar Test Facility.

"We test a lot of equipment for defense contractors and people in the security industry," said Gary Steigerwald, public affairs officer for the Naval Undersea Warfare Center. "They're testing equipment that, in a lot of cases, they just don't want people or other companies to know about. They want it kept confidential."

Steigerwald also says that, unless you're interested in electronics, the stuff that goes on at the facility is actually pret-



The cranes on the Navy barge in Seneca Lake are used to lower objects into the water for testing, in conditions simulating surface ships or submarines.

The main focus is on underwater acoustic testing of sonar equipment, which is usually intended to be used in ships and submarines, not just for the U.S. Navy but for militaries all over the world.

"In the acoustics world, this place is world renowned," Steigerwald said.

The tests conducted at the fa- and energy a piece of equipment generates, a job made much easier because of the natural specs of Seneca Lake, Steigerwald said.

Even though Seneca Lake is a freshwater body, measurements taken in its waters can easily be adjusted to determine how a piece of equipment will react in the saline waters of the

Hammond talked about some of the qualities that make Seneca Lake a perfect environment for underwater testing. Outside of the Great Lakes, it is the deepest freshwater lake east of the Mississippi River. Also, testing can be done year round at the facility, where wind speeds rarely exceed 20 knots, and waves, though they can be quite high

foot in height.

Hammond admitted, howe er, that noise created duri the summer boating seas does sometimes present sched ing challenges.

"The amount of research ga ered at the barge in the last years, parameters which ge erally have remain unchange makes it cost-effective to co here and test equipment," Ha mond said.

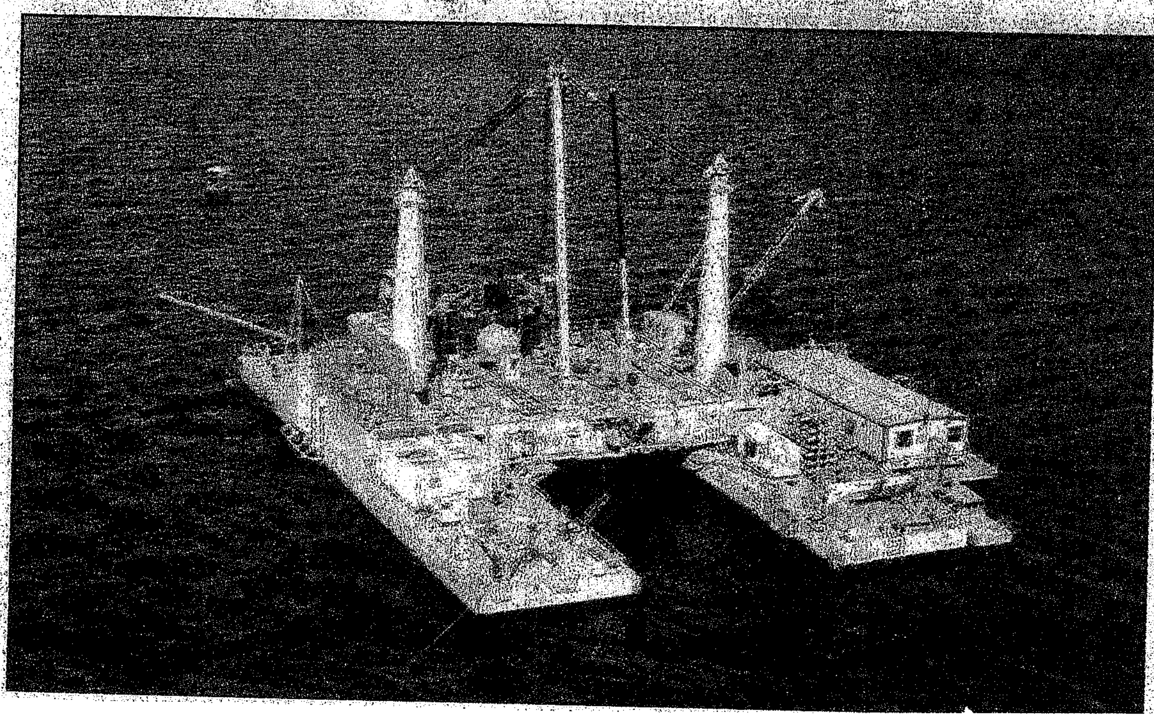
"You don't want to take multi-million dollar piece equipment to sea for the fi time and hope it's going work."

Hammond said the heavy li ing capability of the barge al makes it an appealing test si From the shoreline, the highe visible part of the barge is 220-ton derrick crane built on the barge platform, which w

The pullies of the cranes can hold up to 220 tons of equipment and lower it into the waters of Seneca Lake.

Mark Hammond (top) is shown next to a large panel that was constructed to act like the side wall of a submarine for testing various pieces of equipment.

Right, an aerial view of the Navy's Perry Point facility, which serves the Navy Barge in Seneca Lake. (Photo provided.)



mind. There also are 10-ton hydraulic cranes on board and the original Wiley Crane, built on the barge in 1964.

"The Wiley is the only one in the world and there are only so many people that can operate it," Hammond said. "And I've got two of them working here."

By using 20- to 60-foot long stainless steel stringers, the cranes can lower equipment to the bottom of the lake, which is approximately 480 feet below the barge and 600 feet in its deepest spots.

Hammond said the 220-ton crane can also simulate a helicopter using dipping sonar, which is equipment that is lowered from a helicopter into the water to help detect ships and submarines.

"This is a very valuable service to the Navy and it has proven itself year after year," Hammond said.

"We can simulate, very accurately, what a ship or submarine is going to encounter at sea in terms of sonar capabilities."

Steigerwald added that the Seneca Lake Sonar Test Facility also helps the area economy. Customers stay at local hotels, eat at area restaurants and use other nearby facilities.

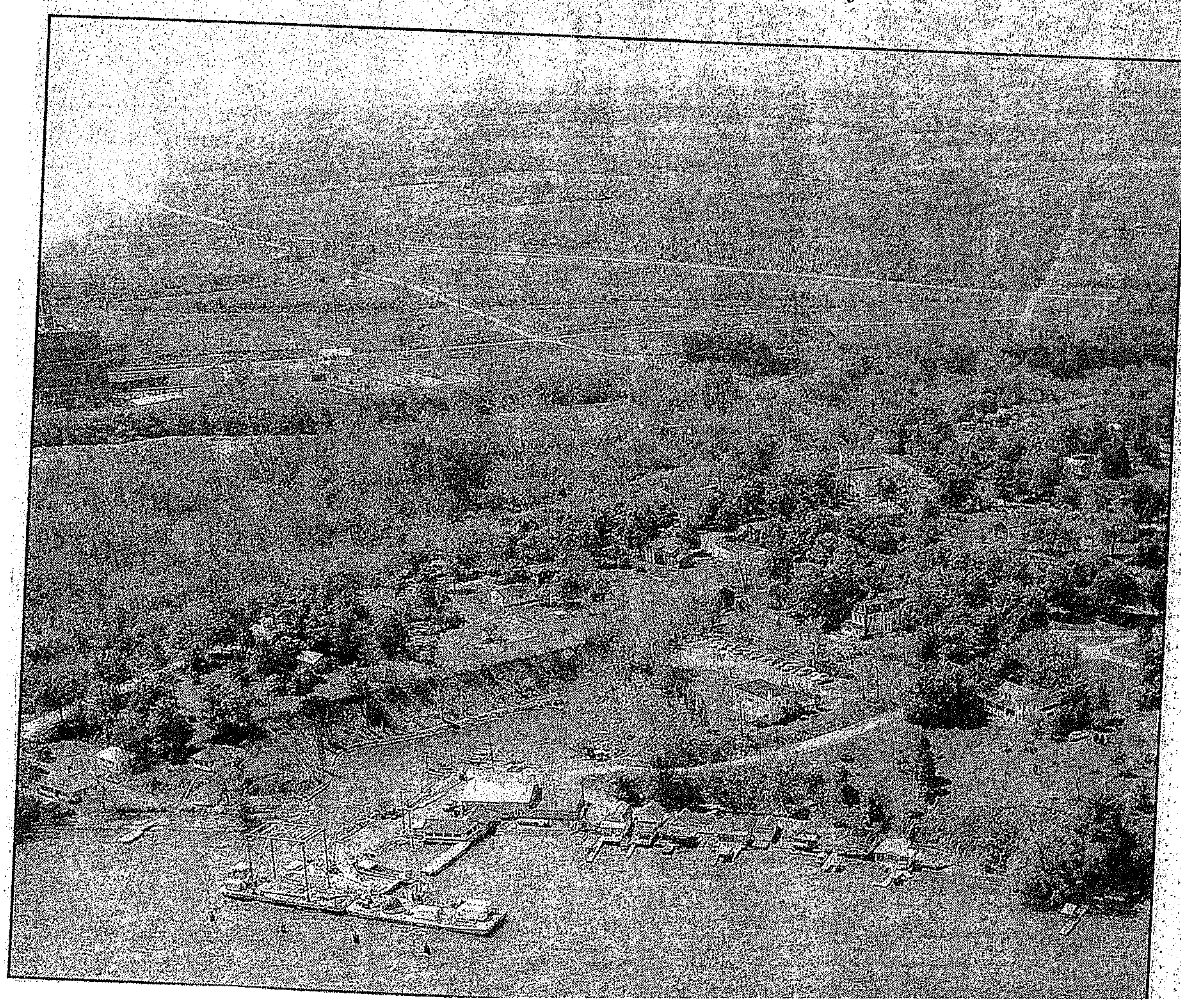
"I spend over $100,000 annually in minor repairs alone," Hammond added.

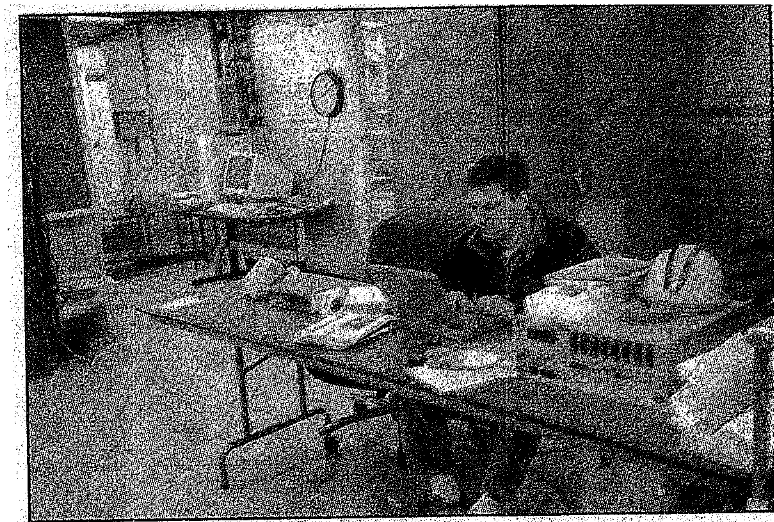
Another feature of the facility is its easy accessibility through the New York State Barge Canal system, the same route that got the barge here in the first place 39 years ago.

Meanwhile, thousands of boats have cruised past the Navy barge over the years loaded with spectators curious about the goings on aboard the mysterious steel conglomeration.

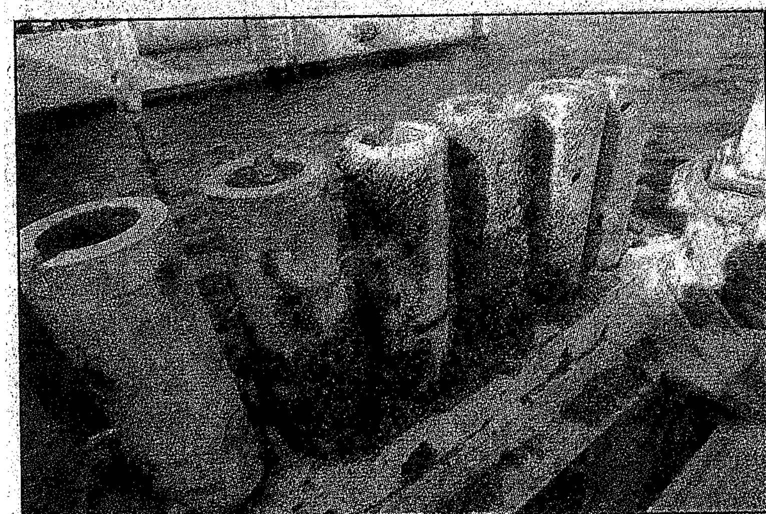
Will the rumors continue to circulate about top secret, highly-classified activity and Russian submarines?

Probably as long as those pleasure boats continue to cruise by.





Some of the daily work is done in enclosed areas of the barge.



Zebra mussels line the outsides of this equipment, into which sensors are dropped. The mussels are being exposed to the air to kill them.

[illegible] outside of the Navy barge from the boat that ferries visitors from [illegible] facility at Perry Point.

FROM THE FILES

50 YEARS AGO
NOV. 9, 1949

LORE OF LAKE COUNTRY INDIANS DISCUSSED BY CORNELL AUTHORITY. "There was a civilization here in the Seneca Lake Country, 4,200 years ago and the people were voting to determine who should wear the feathers" declared Dr. Earle A. Bates, speaking in the Methodist Church at a dinner meeting of the Brotherhood.

The Cornell University Indian authority, who has been honored by two governments for his work with primitive peoples was introduced by Arthur H. Richards Jr., newspaperman.

"The Seneca and Cayuga Indians and their descendants had active political, social and religious groups," he said. "This Seneca Lake Country was sacred soil made hallowed by the Great Spirit and the Indian was jealous of his lands."

Corn was considered the great gift of the Great Spirit and the Indian had great reverence for his only domesticated animal, his dog. "In the old days the Indians believed dogs could talk," he said. "There are no curse words in any Indian language. It is an Indian legend that the Great Spirit became angry because a dog tried to swear like a white man and that great gap in the land, Watkins Glen gorge, was formed!"

He told of the time the Jesuit fathers came to the Lake Country in 1656, of their writing how the lands around Seneca Lake abounded with game and fish.

"In 400 years of fishing, Seneca Lake has not been depleted," he said. Catharine Marsh, between Watkins Glen and Montour Falls, was termed "Bad Indian Swamp."

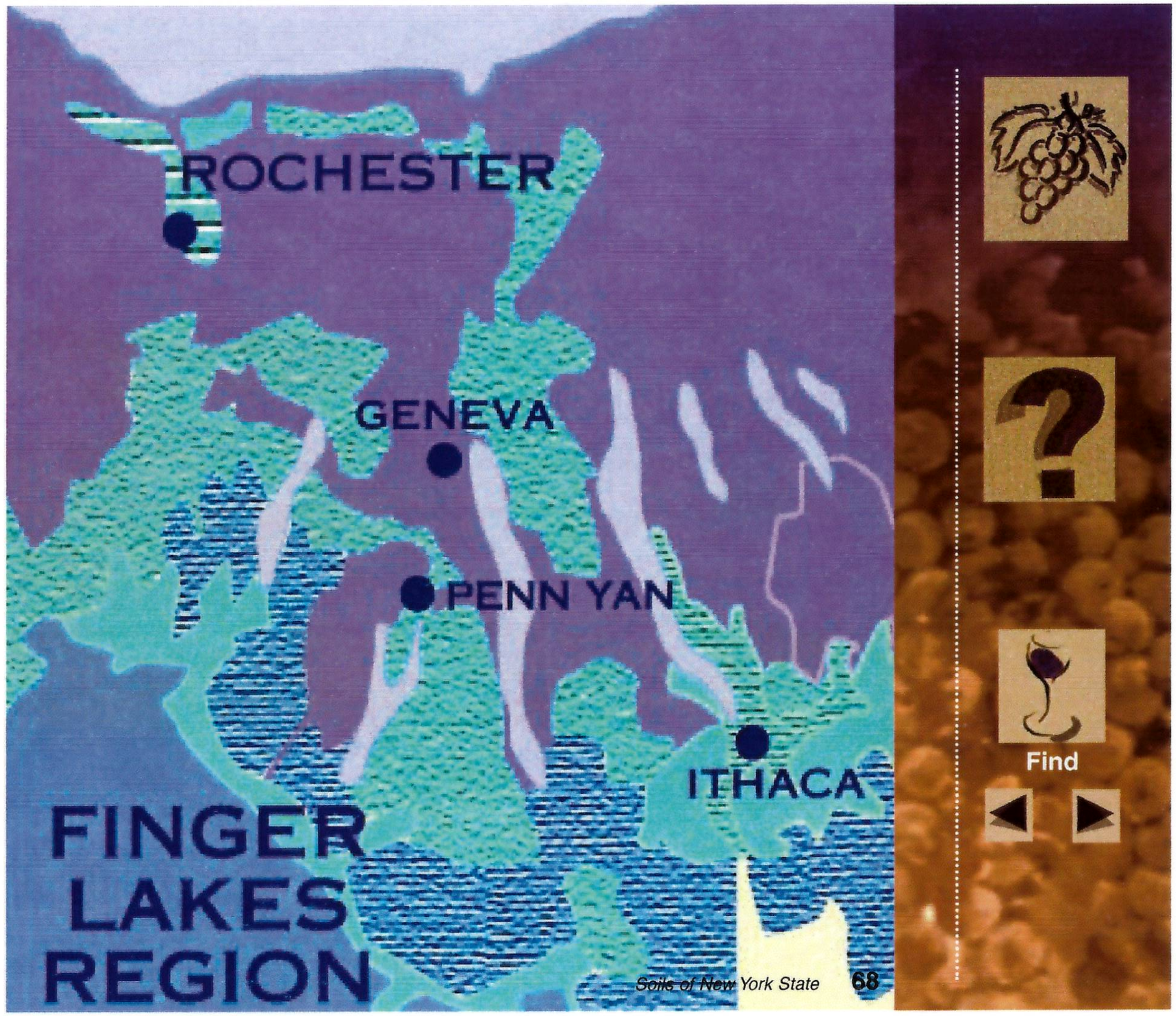
During his talk, Dr. Bates revealed that in Excelsior Glen at the foot of Burdett Hill, near the southeast corner of Lake Seneca, were pictographs placed on the walls long before the Iroquois.

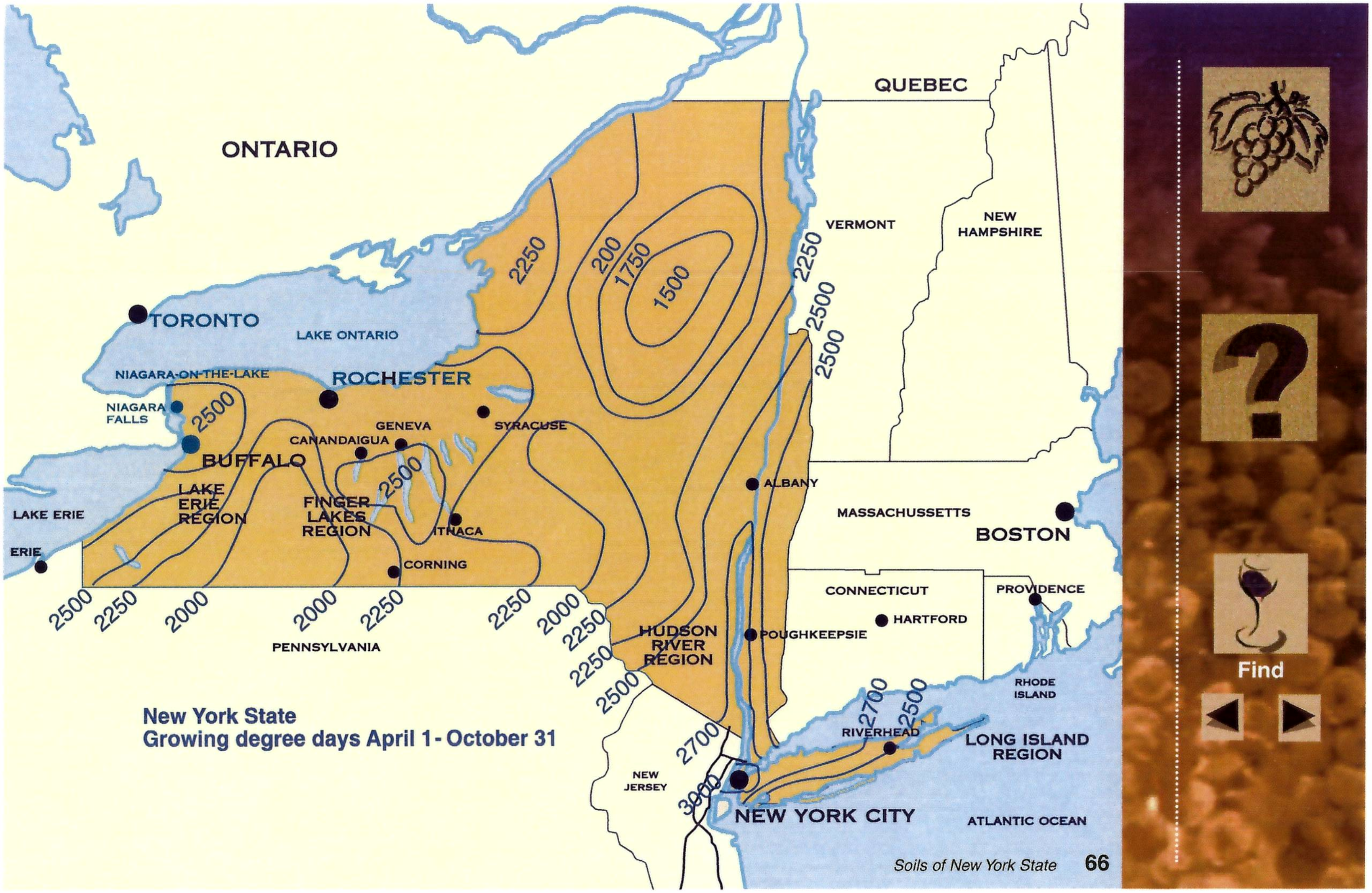
Dr. Bates closed the meeting with a prayer in the Indian Iroquois language after which he said the prayer in English.

Soil Map Legend

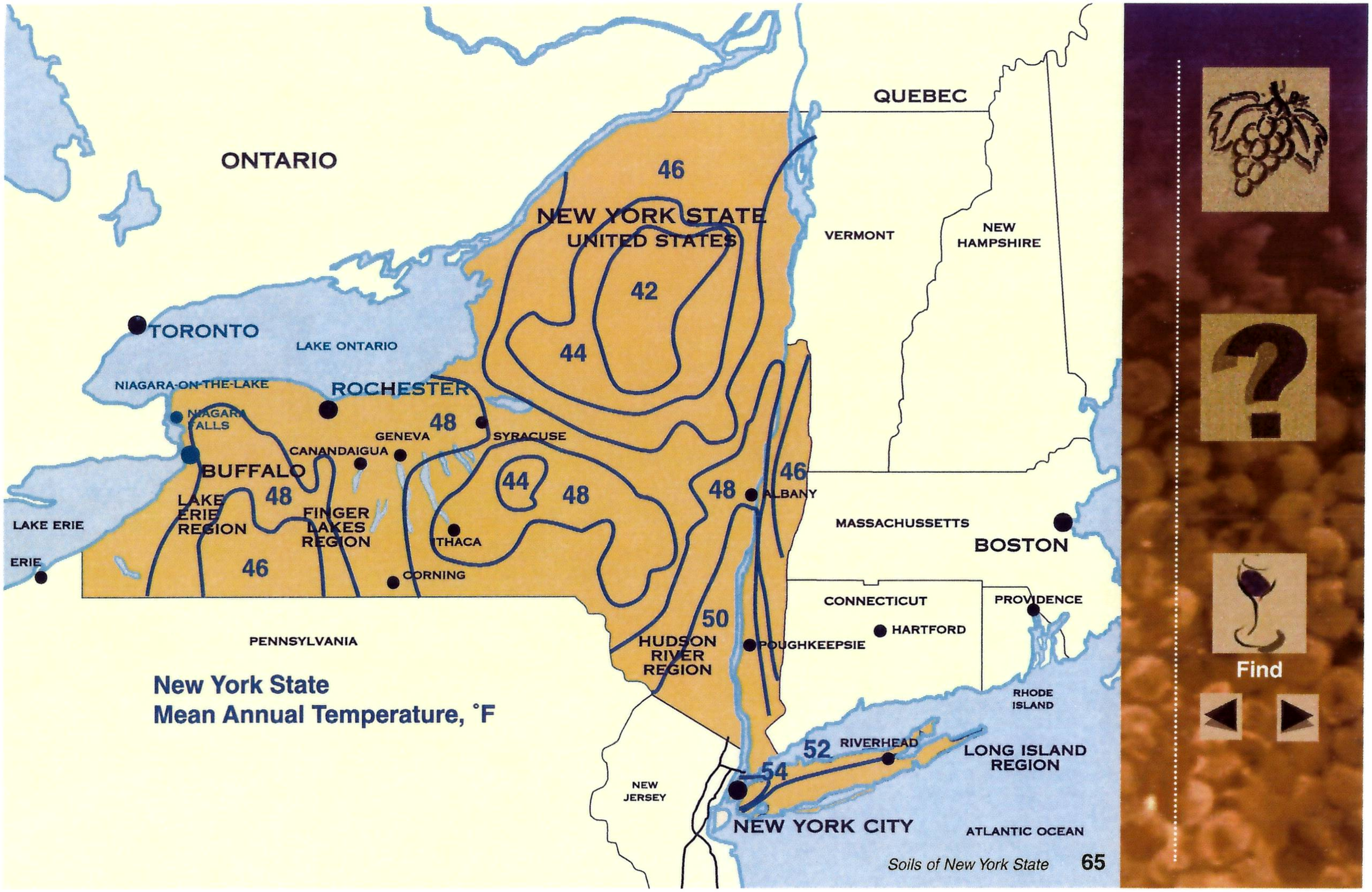
- Areas where more than 60% of the soils are suitable for agriculture with no more than moderate limiting factors.
- Areas where more than 60% of the soils are suitable for agriculture but most have severe problems of wetness, droughtiness, stoniness, depth or slope.
- Most soils in these areas have severe problems of depth, slope, wetness, stoniness or droughtiness that greatly limit or prevent conventional agriculture.
- Water (lakes, rivers)
- Soil use restricted by slope
- Soil use restricted by wetness
- Soil use restricted by droughtiness

Clear areas, i.e. those lacking patterns, have no significant factors limiting their use in agriculture.





New York State
Growing degree days April 1 - October 31



New York State
Mean Annual Temperature, ˚F

HOBART AND WILLIAM SMITH COLLEGES

Seneca Lake

Celebrating Seneca

- The Hand of Man
- Legends of the Lake
- Pumping Cash Out of Seneca
- Something about fishing.
- Why Seneca?
- Frozen in Time
- The Lakes Country Rambler
- Counting on the Lake

Back to the Seneca Lake homepage.

Skimming the Surface

Essential facts, websites, and books about Seneca Lake

Length: 35 miles

Width: 3.2 miles, maximum; 1.9 miles, average

Depth: By most accountings, slightly more than 630 feet; drops to approximately 180 feet below sea level

Shoreline: 75.4 miles

Volume: 4.2 trillion gallons

Inlets: Main inlets are Catharine Creek (Watkins Glen) and the Keuka Lake Outlet (Dresden)

Outlet: Seneca River, also known as "the Canal," joining Seneca and Cayuga lakes at their northern ends

Name: Probably a European misinterpretation of a Native American term for *stone*

Age: Formed by glaciers during the Pleistocene epoch (more than 1 million years ago)

Wineries: 20 (more than any other Finger Lake)

Additional claim to fame: Home to some of the largest lake trout (20 pounds and above) in the world; National Lake Trout Derby held Memorial Day

The main source of statistical information about Seneca Lake is *Persons, Places, and Things In the Finger Lakes Region* by Emerson Klees (1993: Friends of the Finger Lakes Publishing)

Surf the Lake!

Or better yet, surf these lake-related websites.

Seneca Lake is, of course, a Finger Lake, and the Finger Lakes are, of course, tourism. So there is no dearth of World Wide Websites about them.

Commercial/Tourism Sites

These three sites offering tourist information. All are maintained by commercial services, but attempt to offer far-reaching listings of recreational, cultural, and educational opportunities. In no particular order:

- www.roundthebend.com/finger/
- www.fingerlakes.net
- embark.com/fingerlakes/

Governments/Chambers

The Geneva Chamber of Commerce site is at www.genevany.com/, and will point you to many other good sites. Also, there are sites for the neighboring counties at www.ontariony.com, www.yatesny.com, and www.seneca.org.

Fishing?

See www.gorp.com/gorp/location/ny/finger/, containing fishmaster Fred Kane's assessment of the individual Finger Lakes.

Incidentally, many of the above sites are accessible via the HWS Website at Campus: Local Culture.

Seneca Lake in Print

A few books about Seneca Lake and the Finger Lakes region

The following titles pertaining to the lakes are commonly available. All are stocked, in fact, at the College Store:

> Richard Figiel, *Culture in a Glass: Reflections on the Rich Heritage of Finger Lakes Wine* (1995: Pioneer Printing)
>
> Kathryn Grover, *Geneva's Changing Waterfront, 1780–1980*

Kathryn Grover, *Geneva's Changing Waterfront, 1789-1989* (1989: Geneva Historical Society)

Charles Harrington (photographer), *The Finger Lakes of New York* (1996: Norfleet Press)

Emerson Klees, *Legends and Stories of the Finger Lakes Region* (1995: Friends of the Finger Lakes Publishing)

Emerson Klees, P*ersons, Places, and Things In the Finger Lakes Region* (1993: Friends of the Finger Lakes Publishing)

Carol Sisler, *Seneca Lake; Past, Present, and Future* (1995: Enterprise Publishing)

Deborah Tall, *From Where We Stand* (1993: Alfred A. Knopf)

In addition, the collected writings of Arch Merrill are available in a series from Empire State Books, some of which are stocked at the College Store.

The Colleges' archives hold Honors projects pertaining to Seneca Lake, as well as the book *The History of the Wandering Jew: A Legend of Seneca Lake, Queen Katherene, Hector Falls, Romantic Watkins, and Geneva, Beautiful Geneva* by Phoebe Dey Jackson, published in 1898. These do not circulate, but may be viewed.

The Seneca Lake series was researched and written by Dana Cooke and Peter Rolph '85 — writer/editors in the Office of College Relations. Portions of the series also appear in the Fall '97 issue of The Pulteney St. Survey. To request a copy, e-mail Dana Cooke at cooke@hws.edu.

HOBART AND WILLIAM SMITH COLLEGES

Seneca Lake

Celebrating Seneca

The Hand of Man

Legends of the Lake

Skimming the Surface

Pumping Cash Out of Seneca

Something about fishing.

Frozen in Time

The Lakes Country Rambler

Counting on the Lake

Back to the Seneca Lake homepage.

Why Seneca?

The lake and everything else Seneca continues a European misinterpretation of terms.

While most Finger Lakes bear names taken, however awkwardly, from Native American languages, Seneca's name flows from a peculiar alchemy. Indians living around the lake were known, before Europeans, as the "People of the Hill." For whatever reason, their modern name evolved instead from a term for stone, or "people of the stone," or "stony place." By one version of the story, a Dutch physician, using his own language to describe "people of the stone," gave us *sinnekar*. Others attribute it to a European corruption of the Iroquois term *assiniki*, which means "place of the stone" or "stony place," or the Algonkian *otsinika*, meaning stone. From there came the adaptation Seneca — an allusion to the Roman philosopher. It was a likely adaptation, given the slew of Upstate New York towns named for classical sources (e.g., Syracuse, Rome, Ithaca, and Troy). — P.R.

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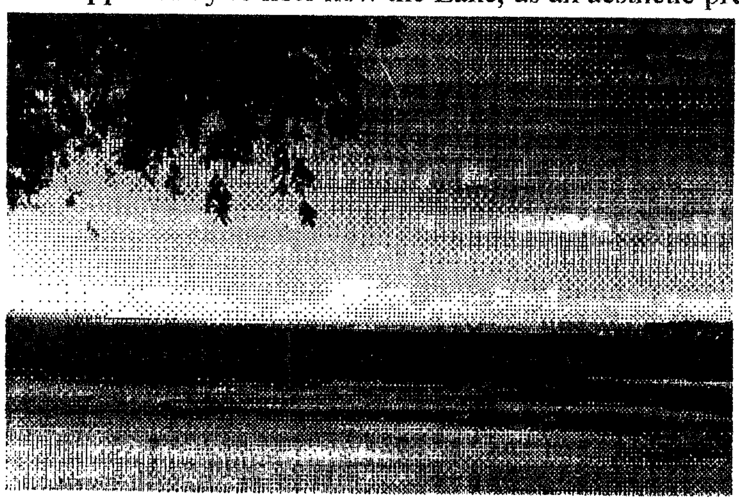
Counting on the Lake

Somehow the thing gets into your psyche.

Celebrating Seneca

There's just one more thing about Seneca Lake. And it's kind of hard to explain. If you've been around the Lake a while, you start to depend on it. When you are away, you miss it. When you need to figure something out, you visit it. For many people who have spent a part of their lives at Hobart and William Smith, Seneca Lake is a kind of diety, or shaman, or muse.

Deborah Tall, professor of English, in her book *From Where We Stand* (1993: Alfred A. Knopf), attempts to explain how a sense of belonging to a place defines both cultures and individuals. She provides some of the most explicative language on this otherwise intangible facet of Seneca. Alongside her observations of the facts and follies of everyday contemporary life, Tall finds opportunity to note how the Lake, as an aesthetic presence, serves as an oasis of steadiness. A constant font of the long-range view. "What it gives most freely," she says, "is the chance to muse."



The lake, she states elsewhere, is "a dramatic, compelling presence. Windy days it threatens the docks, turns into a vengeful sea. Summer evenings it can be so still, to dive into it is to send out shuddering rings as far as the eye can follow. Winter mornings, when its relative warmth hits the cold air, it hoods itself in an eerie cloak of mist. Sunsets, it's painted with heartbreak. It is, above all, a focus, an organizer of the view. I've come to count on the lake."

And near the book's end, she relates an experience that travelers returning from parts south frequently repeat."When I crest a hill to find Seneca Lake laid out before me, my heart pings with a sense of hitting center. The lake is where I first fell in love with this place, and it is still what opens a keenness in me, what makes lines of poetry leap into my head. It is where I know my most generous impulses," she writes, "my greatest optimism." — D.C.

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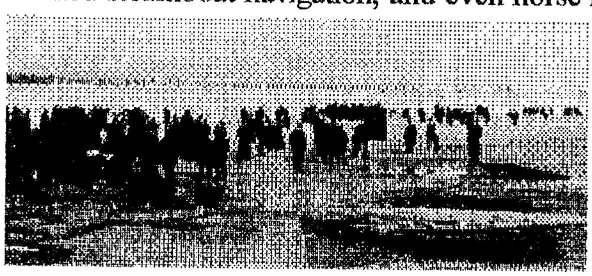
Frozen in Time

Seneca Lake freezes over only slightly more often than that other place.

Owing primarily to its depth, Seneca Lake fully freezes over very rarely. Memories of those occasions are the stuff of lore, sometimes open to debate. It's the kind of thing that used to happen more than it does today.

The late Robert Edwin Doran '22, a local physician and amateur historian, in his serial memoirs published in the *Finger Lakes Times*, included a 1979 accounting of recorded lake freeze-overs. There were four: 1855, '75, '85, and the last in 1912. None has been recorded since Doran's article. The author collected newspaper accounts of skating parties, iceboat accidents, blocked steamboat navigation, and even horse races on the lake. (A collection of Doran's writings is held in the Colleges' library.)



The late E.E. Griffith, professor of English and drama, once told Professor Ted Theismeyer that as a child he had skated from Geneva to Watkins Glen — roughly 35 miles on blades. And in her recent book *The Names of Things: A Passage in the Egyptian Desert*, Susan Brind Morrow, who grew up in Geneva in the 1960s and '70s, recalls a first-grade teacher's story of "a thousand swans [who] came down on the lake to land and froze to death. Their feet stuck to the ice and they could not take off again."

It is difficult to assess the veracity of this last report. A thousand swans on Seneca Lake seems only slightly less likely than, say, Hell freezing over. — D.C.

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8. In June 1957 Roy Japp guided Gypsy Rose Lee to some good fishing.

where the different fish are located, how to fish for them, and where to launch a boat.

When the famous movie actress, Gypsy Rose Lee, was visiting in the area, she wanted to pursue a favorite recreational interest—fishing. On June 24, 1957 Roy Japp was the guide on Seneca Lake. She had good luck and recommended his services to several famous friends. Japp recalled that when he began guiding after World War II he charged $25 a day. Now guides charge $250 a day.

Charter fishing boats also provide service on Seneca Lake. This is a growing business—twenty-five years ago only about five captains offered their boats for fishing. Now sixty to seventy licensed charter operators seek fishing parties. This competition has resulted in an income decline. Also the lure of salmon fishing on Lake Ontario has led fishermen away from Seneca Lake.

Reflecting on a ten pound lake trout of stocked origin caught in 1994, Dr. Ralph (Buzz) DeFelice of Kashong commented:

> This is a typical chemically dependent Seneca Lake trout. Without chemical control of the non-native lamprey, the lake trout population would be decimated causing overpopulation and die-off of the non-native alewives. Without stocked trout and lamprey control, the balance would be upset. Chemicals keep the lamprey in control while the stocked trout keep the alewives in control. No one knows what the effect of the latest non-native species, zebra mussels, will be.

X.
The State of the Lake

Let's consider some of the implications of Dr. Felice's quo-ion in the previous chapter. Is he saying that the natural ele-ents of the lake are now only maintained by unnatural means? ıce the hand of man made many changes around the lake, can e lake be maintained as a recreational resource only through ther intervention by the hand of man?

Let's revisit the north and south ends of the lake to identify me of the work by man which has caused changes in the lake. r instance the canal system created revisions in the course of e Seneca River, eliminating the Indian fishing spots and all of e old town of Seneca Falls. The lampreys entered Seneca Lake rough this same system. The commercial development on the eneva waterfront caused considerable pollution and the fill ed to cover the decline of the nineteenth century industry as ell as the phosphates which entered from the sewer system couraged the growth of weeds.

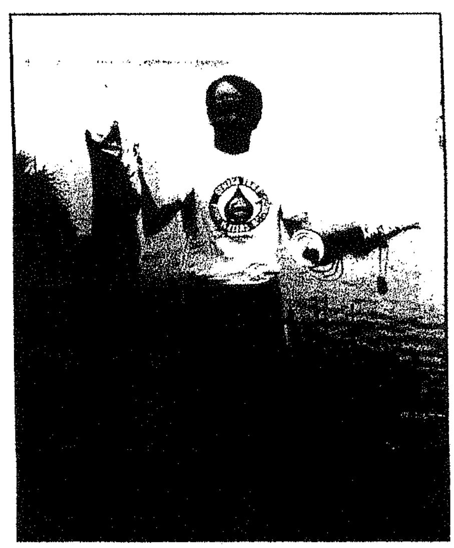
At the south end, to prevent the periodic flooding of Montour lls, great earthen dikes were constructed and the flow of tharine and She-qua-ga Creeks were redirected.

Now that cottages and year-round residences have been con-ructed too close to the lakeshore the flooding which was a nat-al occurrence is a financial disaster of major proportions. The ke level has been controlled by man for many years and if meone misjudges the conditions and flooding does occur, the llowing acrimonious debate is not pleasant.

So it seems that while Seneca Lake was created by natural henomenon and existed in an undisturbed state for thousands f years, in the last two hundred years, it has fallen under the ontrol of man and that is unlikely to change. In fact since the 960s layers of private and public organizations have formed hich are now overlapping in their eagerness to improve the ate of the lake.

In 1965 the Seneca Lake Waterways Association Inc. was corporated with an action agenda including control of weeds, e water level, water pollution and duck hunting. The attorney r the organization, Richard Mulvey whose family owns proper-y on East Lake Road, exclaimed that the sudden growth of

1. Dr. Ralph (Buzz) DeFelice of Kashong holds symbols of his two Seneca Lake interests—a 10.25 pound lake trout and the Kemerer water sampling bottle.



weeds would choke off Seneca's water and create a land-locked lake. As to the lake level, the members wanted it to be from 444.6 to 446.5 feet from November 1 to May 1 and from 446 to 446.5 feet from May 1 to October. They supported Governor Nelson Rockefeller's $1.7 billion program to combat water pollution. They called for a split hunting season for ducks, regulation of fish pirates and commercial fishing, and the rejuvenation of the lamprey control program.

Initially full of ambition, this organization hoped to enlist 2,000 members and to influence state initiatives to improve the lake as well as stimulate private efforts. As happens with citizens organizations, the members suffer burn-out and the association dies.

When the research for this book began, the Seneca Lake Waterways Association was inoperative, but the Seneca Lake Pure Waters Association had just issued its first newsletter in the summer of 1991. With start-up funding from the Frank E. Tripp foundation (Mr. Tripp summered at Glenora), with Buzz DeFelice as president and Mary Ruth Sweet as executive director, the association has undertaken a comprehensive program similar to its predecessor. Its primary goal is education—encouraging the understanding of the lake and the interrelationships between water, land, air, plants, and animals. To this end, it publishes a lively newsletter titled *Lake Watch* with interesting articles about the lake level, zebra mussels, and a column of letters to the editor under the heading "Voices of the Lake." It also sponsors workshops, public meetings, and conferences.

Monitoring the water quality of the lake is another important effort. Trained members engage in the CSLAP program, which stands for Citizens Statewide Lake Assessment Program. They take water samples periodically at designated sites around the lake, record the results, and ship the samples to a certified laboratory for additional testing. They also watch the lake for high levels of pollutants, excessive algae or weed growth, dying fish, and sedimentation.

Nonpoint source pollution is new terminology in the environmental field. It means pollutants come from many sources—oil dumped in the storm sewer, cow manure carried into a creek, sediment flowing into streams from farm fields—rather than one source such as liquids flowing from a factory pipe. Association members study the land use patterns around the lake and check the streams flowing into it for pollution.

Finally the association encourages recreation on the lake including safe boating and sailing conditions, clean swimming areas, and abundant fishing opportunities.

Off to a good start, Buzz worries about burn-out already. He's having trouble finding someone to succeed him as president and others to accept chairmanships.

As to the layers of organizations overseeing Seneca Lake water quality, the association promotional brochure mentions it supports the efforts of the Environmental Protection Agency, the Department of Environmental Conservation, County Soil and

SENECA
LAKE
PURE WATERS
ASSOCIATION INC

Water Districts, Cornell Cooperative Extension, the New York State Federation of Lake Associations, and the North American Lake Management Society. Add to these the New York Water Pollution Control Association Inc., the New York Nonpoint Source Coordinating Committee, and the Seneca Chapter of the Finger Lakes Land Trust with offices in Ithaca.

Seneca Lake Research

Limnology is the scientific study of lakes, stream, ponds, and other bodies of fresh water. Limnologists assess the chemical and physical characteristics of fresh water lakes as well as the interaction of plants, animals, and fishes with their watery environment.

The first study of Seneca Lake was made not by scientists but by students and faculty of the Civil Engineering College at Cornell University. From 1874–1897, they devoted part of each summer to mapping the five major Finger Lakes. This included not only soundings for depth and contour of the lake's bottom but also shore topography.

In 1910 the United States Bureau of Fisheries engaged Edward A. Birge and Chancey Juday, associated with the Wisconsin Geological and Natural History Survey, to study the Finger Lakes. They had just completed a study of the Wisconsin lakes and felt that the New York lakes would reveal similar information. Their efforts concentrated on dissolved gases, plankton, and temperature. They estimated that the heat released by lake water in the winter per square mile equaled the heat generated by the combustion of 150,000 tons of coal. Their extensive description of the data on the lakes was published as "A Limnological Study of the Finger Lakes" in the 1912 *Bulletin of the Bureau of Fisheries*. Further limnological observations were printed in the 1921 *Bulletin*.

In the early 1970s the Community College of the Finger Lakes sponsored the Finger Lakes Institute based in Watkins Glen and operated the first research vessel on Seneca Lake. Named the *Lake Diver IV*, it was sixty-five feet long and took students from Alfred, Elmira, Hobart and William Smith Colleges on the lake to collect water, sediment, and plankton samples. Because Seneca Lake rarely freezes, the ship operated twelve months of the year but eventually became swamped by rising costs for diesel fuel and parts and the program was terminated.

Since 1971 William F. Ahrnsbrak, professor of oceanography at Hobart and William Smith Colleges, has been studying the lake and he wanted to continue his work from a research vessel. With the encouragement of the colleges' administration, he located a former United States Navy tug boat, sixty-five feet long, and slowly brought it through the canal system, stopping in Baldwinsville for repairs and outfitting. Arriving on Seneca Lake in June 1976, renamed the *H.W.S. Explorer*, it is used daily by the colleges' students for a variety of studies. The former cabin is outfitted with a long laboratory table on which beakers, flasks, and microscopes rest and nearby is the computer for entering data. It is equipped

2. Hobart and William Smith Colleges acquired the Explorer *in 1976. (Inset) Pictured from the left are William F. Ahrnsbrak, John Nichols, captain, John Abbott, mate.*

with an eight-ton hydraulic crane which lowers bottles to the bottom of the lake to collect water and mud samples.

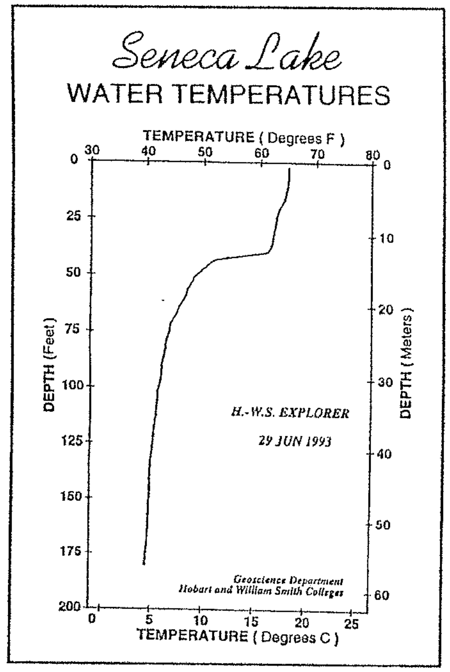
During the summer, the *Explorer* hosts science teachers and high school students participating in the Science on Seneca program and it is also available for charter. From December to March it is moored at the Seneca Lake Marina with bubblers around it to prevent freezing.

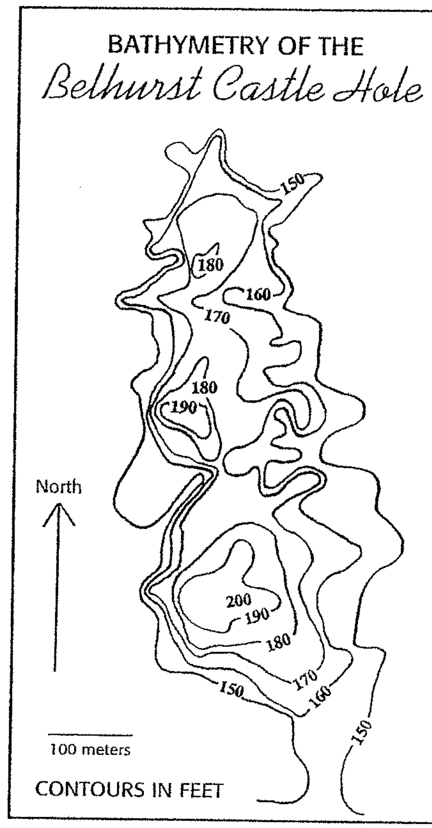
A lanky, bearded man, Ahrnsbrak takes out the *Explorer* every Wednesday to check the water temperature at a certain location off Clark's Point. In 1994 the captain of the ship was John Nichols, a retired state trooper formerly assigned to the boating safety division on Lake Ontario. The mate was John Abbott, who worked on a one-third time basis. While the computer stores the temperature differentials, during the summer the resulting graph is printed in the Finger Lakes *Times* so fishermen can locate the thermocline where the lake trout lurk.

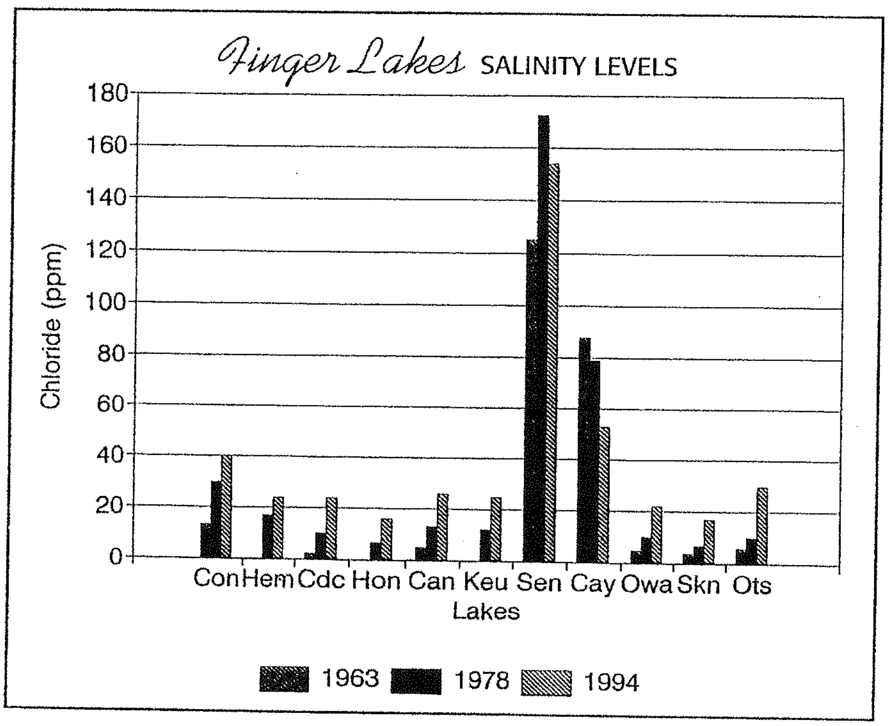
Along with his colleagues in the Geoscience Department, Don Woodrow and Michael Wing (who relocated to California in June 1994), Ahrnsbrak has determined that the salinity level in Seneca Lake is two to ten times higher than in the other Finger Lakes. After testing the discharges at the salt plants and the outlets of the eight major creeks, Ahrnsbrak and his colleagues hypothesize that the bottom of the lake is so deep that it intersects the salt veins at the south end of the lake. The chloride seeps into the water causing readings close to 200 parts per million. When the findings were released in 1975, health officials speculated that the level might reach 250 parts per million which would cause the water drawn from the lake for drinking purposes to be unhealthy, especially for cardiac patients. However by controlling the emissions from the salt plants and diminishing the use of road salt, this has not happened.

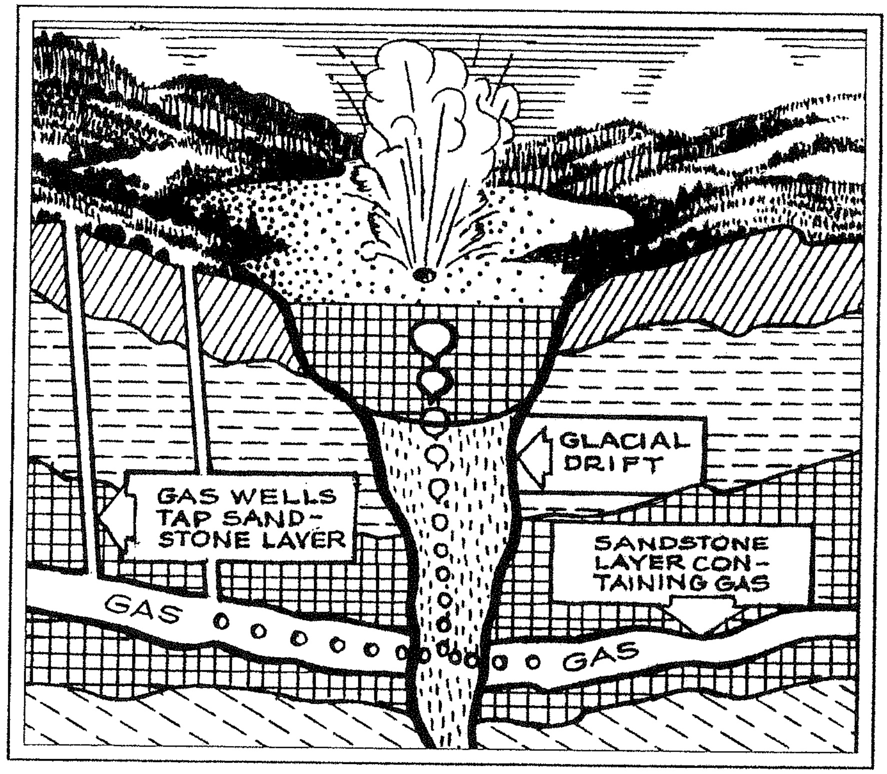
Amy Preston, an undergraduate, studied a unique phenomenon in Seneca Lake—the Belhurst Castle Hole, which drops almost two hundred feet deeper than the surrounding bottom. She found that the salinity in the hole was almost double that outside the hole and speculated that the hole might be a major contributor to the chloride level in the lake or that the lake currents could not reach into the hole to mix the water because of the steep walls. After considerable testing, she discovered that the saline levels do vary and that lake currents are able to flush them.

This leads to wave action on or under Seneca Lake. On March 21, 1928 a tidal wave rolled into the south shore at Watkins Glen which raised the lake level two feet at the Lembeck Malt House on East Fourth Street. A boat, *Captain Henry Goss*, was in Lembeck's loading slip when the wave hit. Loaded with 9,500 tons of









3. This picture illustrates the means by which natural gas reached the surface of the lake.

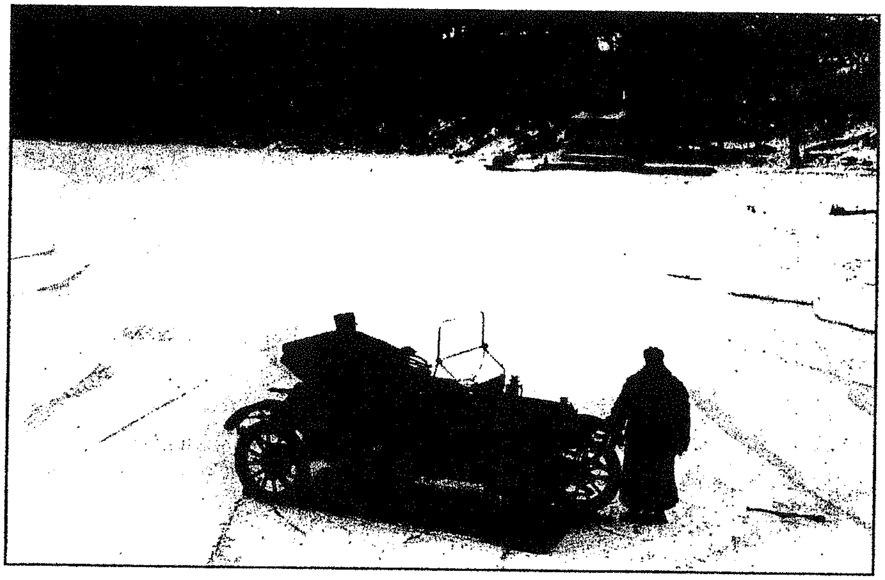
barley, the ship was lifted with such force that its four mooring ropes were split from the dock. With the receding wave the ship was grounded on the west bank. Joseph Benson, captain of the craft and a lakeman for thirty years, had never experienced such a phenomenon. It occurred about the changing of the wind from south to north.

But Ahrnsbrak is more interested in the internal modular surge—the underwater wave action which is considerable. This powerful motion can reach thirty feet and have considerable effect on the lake sediment. By using SCUBA divers, underwater television, sonar, and sophisticated measuring equipment, he has determined that the waves do hit the Seneca Lake bottom and result in current speeds capable of moving sediment.

Natural and Unnatural Phenomena

Several Indian legends were centered around Seneca Lake. One has to do with a Seneca warrior who was struck by the God of Thunder as he hunted a bear near the edge of the lake. The lightning cast both the warrior and a large tree into the water. When a storm passed over the lake, the next day the dead tree appeared on the surface floating like a funeral barge. The spectre was seen over and over again just before a storm. When the thunder rumbled, people speculated that the wandering chief was on the march.

Perhaps what they heard were the Guns of Seneca; people said they often occurred during the still heat of summer just before a thunderstorm. While surrounding the Guns with myths



4. When the lake froze in 1912, John Townsend and Julius Hoffman of Lodi drove their automobile on the lake.

gives them an air of mystery, the explanation, if accepted, was very simple. It was again related to the lake's great depth. Within the sandstone layer below the lake, gas sought an outlet forcing its way through many layers of glacial drift on the lake bottom. Ascending through 500 to 600 feet of water, the decreasing pressure would allow the gas to expand twenty to forty times its original volume and it would reach the lake's surface as a large bubble. When the bubble burst and the displaced water receded backward, the booming would result.

When natural gas fields were developed near Tyrone in the 1930s, the lake guns were stilled; however the myths continue.

Like the listing of hymn numbers on the board in a church, the years the lake froze were listed indelibly in people's memories—February 1855, 1875, 1885, 1912. When the lake froze in 1912, the residents around it were really excited and pictures could capture the enthusiasm. Fifty years after he skated across the lake from Dresden to Willard and back on February 9, 1912, Fred Dean remembered how he watched from his bedroom window as the ice closed from shore to shore. He kept watching a dark streak in the lake thinking it was open water but after an exploratory skate, he realized ice covered it. With several friends tied together with clothesline, he skated quickly across the lake. It took twenty-seven minutes over and fifteen minutes back. As long as the ice held, he skated every day including to Geneva and back. Interviewed in 1962 at the age of eighty, he commented, "I figured I'd never see it happen again, and I haven't."

The February 17, 1912 Geneva *Times* reported several ice related happenings.

- G. Allen Burroughs of North Tonawanda, a junior at Hobart, skated to Watkins. He left at 2:10 p.m. and arrived in Watkins at 6:10 p.m. He skated down the center of the the lake and found a continuous sheet of ice. He saw hundreds of ducks frozen in the ice or bewildered wondering what had happened. He returned by train.

Why it was so good f/ grapes
Not to freeze over.

Last time lake froze was 1912.
only 4 times in 146 years
Keuka Lake, However, freezes over
every year.

Gort Types

- William Smith young ladies were cautioned not to go on the ice during the present warm period.
- Edward S. Gordinier, a well-known boatman, cut a large circle of ice about himself, but failed to step out of the circle before it sank with him aboard. He suffered severe wetting and lots of kidding from his friends.
- Many local sportsmen were building ice boats. A good sized fleet will be seen on the lake.

As mentioned, the ducks suffered terribly. Members of the Geneva Rod and Gun Club fed the half-starved birds wheat, while residents of Geneva brought bread to the waterfront.

All in all, a carnival atmosphere existed around the lake as people enjoyed the adventure of doing something they might never do again. The ice disappeared into the deep water about St. Patrick's Day.

The Lake Turning

Every fall and spring the lake turns, a unique process usually identified by a change in the water color to muddy green. This turning over is caused by a change in the water temperature facilitated by the churning action of the wind. In November or December as the surface water cools, it gradually descends mixing with the cold water below. The length of mixing time depends upon wind action. The bottom water about thirty-nine degrees then rises to the surface eventually forming ice if the air temperature drops below freezing for a long period of time. Conversely in the spring as the surface water warms, it becomes heavier than that below and sinks. After the whole body of water reaches thirty-nine degrees, the winds again facilitate the mixing. During the summer the surface water is so warm that it forms a thick layer over the lake which is unable to mix with the cold water below. The lake is then in a stratified condition of three layers, identified by scientists as epilimnion on top, metalimnion in the middle, and hypolimnion below.

Weeds

By 1966 the rampant growth of weeds along the lakeshore not only became a nuisance but also a major concern. At the urging of the Waterways Association, specialists from Cornell University were engaged to identify the weeds and to recommend a method for control. The weeds were eurasian milfoil whose growth was stimulated by the sediment and nutrients pouring into the lake. Of course they were most noticeable near the shore where people want to swim and where boats were launched. The long weed strands often wound themselves around the propeller, thus stalling the motor.

In 1975, Dr. Gary L. Miller, who was associated with Eisenhower College, published the results of his study of aquatic weeds in the Finger Lakes. The maps of Seneca Lake showed a band of weeds varying in width around the shallower northern end of the lake but few weed beds around the deeper southern end. His recommendations for control included the use of a weed cutter, application of chemicals, and control of the nutrients flowing into the lake. Only the latter method was undertaken and over time it seems to have had a positive effect. The weed growth is diminishing.

A relic of the Ice Age thrives in the moist shale banks along the lake in the town of Starkey. Known as Leedy's Roseroot, it has been identified in only five locations in the world, two in the United States. One is along the banks of the Root River in Minnesota and the other is within a three mile stretch along Seneca Lake. In 1991 the owners of an acre lot on the lake deeded it to the protection of the Finger Lakes Land Trust and the Nature Conservancy. They sought the perpetual protection of this rare species rather than the economic gain.

The Zebra Mussel

While the Roseroot established itself over 10,000 years ago, the zebra mussel is a recent intruder. Hitching a ride on a European freighter into the Great Lakes in the late 1980s, the zebra mussel has relentlessly spread throughout the northeast watershed from the Mississippi to the Hudson. Awaiting the marauding zebra mussel army with dread, cottage owners, power plant operators, and corporations prepared to protect their lake water intake lines. This tiny black and white striped mollusk clings to pipelines because they are somewhat protected and can feed on microorganisms as they are drawn into the pipe. Eventually they completely clog the line.

The first sign of the zebra mussel was detected near Dresden and young adults were spotted in 1992. Zebra mussels encrusted an old anchor which was hauled to the surface in the vicinity of East Lake Road. Their shells are very hard and sharp so stout gloves should be worn when work is done around docks and intake pipes.

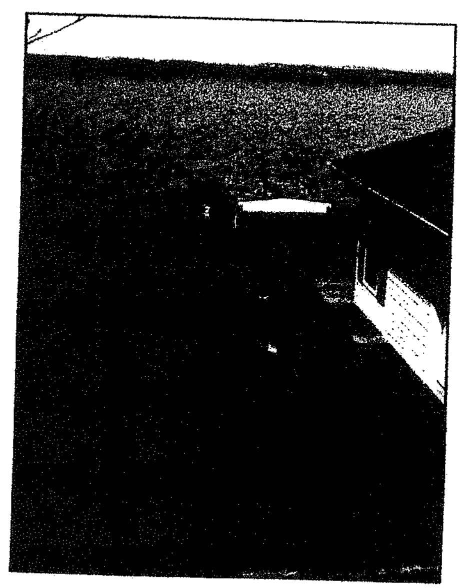
What to do about the mussels? Devices are being manufactured to prevent them from invading intake pipes. Cities and utilities are spending thousands of dollars to protect their waterlines.

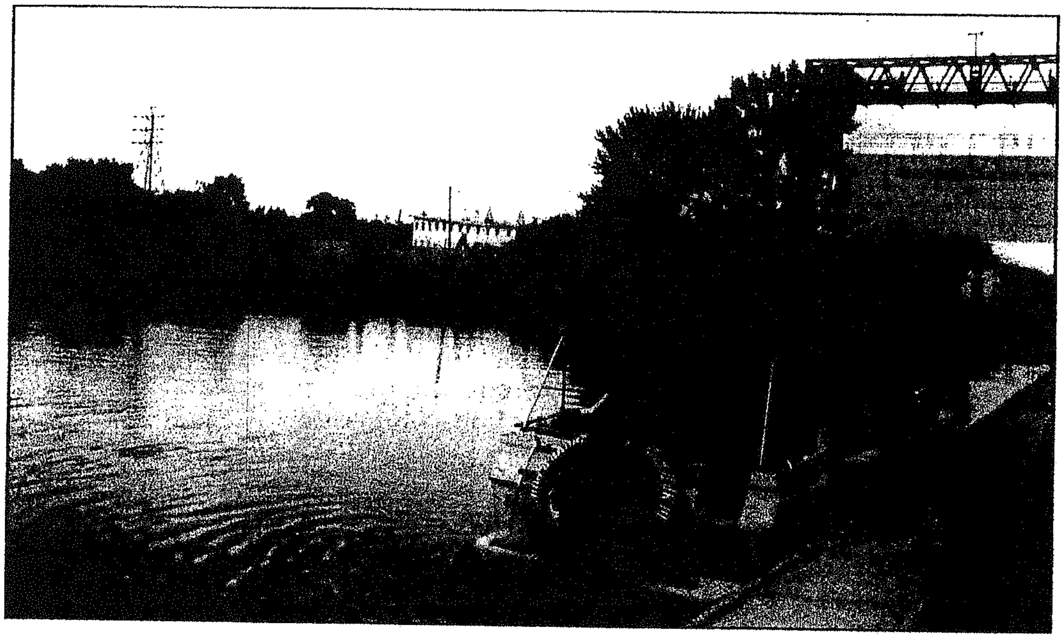
If one good result can come from this most recent lake invader, it is that the zebra mussel may clarify the water by siphoning it through its digestive system. Reports from Saginaw Bay, Michigan, indicate that after an infestation of the zebra mussel, the bay water seemed clearer. Also the mollusk may cleanse pollutants from the water as it feeds. A single zebra mussel filters as much as two quarts of water a day. None of the specialists studying the zebra mussel predicts its decline; rather they consider it a natural phenomenon which is here to stay.

The Lake Level

Nothing inflames the passions around the lake more than the topic of the water level. It's all right to glorify the freezing of the lake in 1912—that happened along time ago. But the accounts make interesting reading. Even the booklets of photographs pub-

5. In the 1993 flood, barrels filled with water or sand hold down a dock.





6. The Taintor gates at Waterloo control the Seneca Lake water level.

lished after the 1935 flood were also interesting as were the personal accounts of those who were swamped by it, for instance the residents of Glenora. But there again time has faded the feelings of emotional terror. The flood in 1972 is remembered with anger because the floodwaters did not recede for a month.

The flood of 1993 is very real to lake residents because as the lake waters rose, they were filling barrels with water to hold down their docks, they were moving furniture upstairs, and after the water declined, they were cleaning the silt from their cottages and burning the flotsam which littered the beaches. To add insult to injury, high water threatened again in 1994. At this point, residents, marina owners, city and village officials, state officials all agreed—no more.

But the state regulates the hand of man which controls the lake level. As part of a three lake sub-system in the Seneca-Oneida-Oswego drainage basin, Seneca receives the flood waters from Keuka Lake, Seneca empties into Cayuga Lake which acts as the reservoir in flood times, bulging with water until state authorities permit the gradual release into the Seneca River. This is done in a restricted manner so the down stream flooding is not as bad as it could be if the outflow were not controlled.

John Zmarthie, Office of Canals, New York State Thruway Authority, is charged with the authority to regulate the lake level. After obtaining the daily numbers, his office instructs the gate keepers to adjust the gates to allow more or less water to flow. Because Keuka Lake is not part of the canal system, his office has no jurisdiction over it. The village of Penn Yan regulates the lake. However Zmarthie can recommend appropriate discharges in times of emergency.

New York State Electric and Gas Corporation adjusts the Taintor gates at Waterloo based on Zmarthie's instructions. There are four gates; three direct water in the corporation's generating plant and the other is opened to handle overflow. The maximum discharge is 2,500 cubic feet per second. It requires 2,000 cubic feet per second to lower the lake one inch in a twenty-four hour period with no precipitation.

At 450.1 feet above sea level in April 1993, Seneca Lake reached a record high and the waters receded slowly in part because the earthen dam adjoining the Taintor gates on Cayuga Lake was under extreme stress. After the flood, the dam was rebuilt and the gates on Keuka Lake were enlarged. In 1992 the Army Corps of Engineers undertook a study of the Cross Lakes-Baldwinsville portion of the flood basin.

Following the almost-flood of 1994, demands were made to lower the winter lake level to 444 feet if the snowpack and ground saturation warrant it. This is a foot below the usual winter level and might cause beach wells to run dry and pipes to freeze but the many public and private interests around the lake feel this action has to be taken. However opponents stress that under normal spring run-off conditions, the lake might not fill enough to permit navigation, energy creation, and municipal waste dilution. Furthermore the tourism dollars spent in the region are considered more important by state authorities than the property taxes paid by cottage owners to local municipalities.

Should the lake ever reach the 450.6 foot level, the water would overflow all the control systems and spread over the Montezuma swamp area which was its natural wetland after the glaciers receded. While one might complain about the numerous organizations that are interested it it, the state of the lake is excellent because it's in good hands.

 by Emerson Klees

SENECA LAKE—INTRODUCTION

Seneca Lake—Description

Seneca Lake was named for the Seneca Indian Nation, one of the six nations of the Iroquois Confederation who used to inhabit the area. The word Seneca is derived from the Indian name *assiniki*, which means "place of the stone" or "stoney place." Seneca Lake has one of the steepest shorelines of all of the Finger Lakes, particularly at the southern end.

Two of the main inlets to Seneca are Catharine (pronounced Cathareen by natives) Creek at the southern end and the Keuka Lake Outlet, which becomes an inlet to Seneca Lake at Dresden. The flow from many ravines goes into the Lake, some of which have spectacular waterfalls, including the falls of Big Stream at Glenora, the falls of Sawmill Creek at Hector, and the Silver Thread Falls of Mill Creek at Lodi Landing. The Lake is also fed by many springs along its bottom. Seneca Lake outlets into the Cayuga-Seneca Canal, which joins Seneca and Cayuga Lakes at their northern ends.

Seneca Lake is the deepest and the widest of the Finger Lakes, but not the longest; Cayuga Lake has that distinction. Seneca Lake is 632 feet deep (off Lodi Point) and 35 miles long.

The bottom falls away quickly; at some places along the Lake, the depth is 50 to 100 feet just 20 feet from the shoreline. Seneca Lake is 3.2 miles wide at the widest point and has an average width of 1.9 miles. The Lake has 75.4 miles of shoreline and a volume of 4.2 trillion gallons. Whitecaps can come up quickly on the Lake, particularly when driven by a south wind.

Because of its large water volume, Seneca Lake has a pronounced moderating influence on the air temperature around its periphery, which is why the Lake has become a prime grape-growing area. The moderating influence on the temperature lengthens the growing season. Severe winter conditions have less impact on non-winter-hardy grape varieties on

Friends of the Finger Lakes Publishing, Rochester, NY

Seneca Lake than on other lakes in the Region. Seneca Lake has more wineries than any other Finger Lake.

The Lake surface has frozen over only nine times since the beginning of weather recordkeeping. Seneca Lake is rated as an excellent lake for fishing and is particularly known for lake trout. The National Lake Trout Derby is held every Memorial Day weekend on the Lake.

Seneca Lake—Brief History

General Sullivan's campaign to destroy the villages and crops of the Iroquois Confederation to prevent the six nations from siding with British during the Revolutionary War devastated the area around Seneca Lake. Sullivan's Army destroyed the homes, crops, and orchards of the Seneca Nation along the entire east side of Seneca Lake from Indian Castle (now Watkins Glen) to Kanadasaga (now Geneva). Sullivan also leveled all signs of civilization on the west side of the Lake from Kanadasaga south to Kashong, five miles south of Geneva.

The first large boat on Seneca Lake was the sloop *Alexander*, launched in 1798 at Geneva. The first steamboat, the *Seneca Chief*, began plying the waters of Seneca Lake on July 4, 1828. She had previously served as the flagship for Governor DeWitt Clinton in the parade of boats that opened the Erie Canal in 1825.

The *Seneca Chief* was followed by many other steamboats, including *John Arnot*, *Colonial*, *W. B. Dunning*, *Elmira*, the wood-burning *Ben Loder*, *D. S. Magee*, *Onondaga*, *Otetiani*, *Schuyler*, *Seneca*, and *Watkins*. These steamboats weren't as safe as modern ships, and many of them had lives shortened by fire. *Onondaga* met with a spectacular end; it was dynamited after a show troupe using the vessel for housing contracted small pox.

Hector Falls, one of the busiest ports during the time of the steamboats, was then called Factory Falls due to the large number of mills clustered along Sawmill Creek, including www.gflrpc.org

Seneca Lake

The geologic history of Seneca Lake began about 550 million years ago when the region sank and was inundated by the Atlantic Ocean. This condition lasted for about 350 million years, during which time there were periods when the sea waters evaporated leaving great salt beds, which are important today as an industrial resource and as an environmental characteristic of Seneca Lake's waters.

About 200 million years ago a vast uplift occurred and the area was subjected to a complex series of erosional forces, ending with two glacial epochs, the last of which ended about 10,000 years ago. Thus the Finger Lakes Region as we know it today was formed, represented by 10 prominent lakes, of which Seneca Lake is the largest.

Seneca Lake covers an area of approximately 67 square miles, is 35.1 miles long and is an average of 1.9 miles wide (Kidder and Ahrnsbrak 1972). The Lake has a volume of 4.2 trillion gallons with a maximum depth of 634 feet. The retention time of the Lake's water is 18 years (Shaffer and Oglesby 1978). The general water clarity is 3 feet (summer) to 30 feet (winter) (Wing and Acquisto 1992). The chloride concentration as a measure of salinity is 150 ppm (Wing et al. 1995). The water remains at 4 degrees centigrade below 50 meters all year, while the surface waters during the summer can reach about 21 degrees centigrade (Wing and Acquisto 1992). The pH of Seneca Lake is nearly always between 8 and 9. This slight alkalinity is due to the buffering of the calcium carbonate dissolved in its waters (Wing and Acquisto 1992). Although the oxygen profile of the Lake changes over time, with oxygen being utilized for respiration by surface organisms and for decay by bottom organisms, the lake does not become oxygen-depleted at depth as do many lakes in the region during summer (Wing and Acquisto 1992). Several studies have found nitrate levels in the Lake range from 17 to 45 micromoles/liter, total phosphorus from 0.2 to 0.6 micromoles/liter and chlorophyll a from 0 to 6 milligrams/liter (Wing and Acquisto 1992). These levels describe Seneca Lake as a mesotrophic lake.

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Culture in a Glass by Richard Figiel

CHAPTER THREE:

LAND & LAKES

When plows and harrows run through vineyards along the Finger Lakes, they occasionally unearth fragments of rock imprinted with seashells. The ocean is 250 miles away. But 500 million years ago this interior region lay under a huge inland sea connected to the Atlantic. It ebbed and flowed across much of what is now New York State for a period of 325 million years, during which the runoff from ancient Adirondack and New England mountains laid down layer upon layer of sediment.

A snapshot of marine life taken a few million years ago, this slab of shale still looks strikingly like a muddy sea-bed. On display at the Paleontological Research Institute near Ithaca, it tells one chapter of a geological tale that lured grape growers to the Finger Lakes.

Millions of years of sedimentation alon
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the thinly layered shale characteristic c
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gulleys and in cavernous gorges where
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and Cayuga.

Not all grapevines do well in high-li
tive-American varieties (Concord, Ca
agara) like more acidic soil, hence th
ger Lakes vineyards tended to stay a

"Culture in a Glass" by Richard Figiel

Millions of years of sedimentation along the bottom of this shallow sea, compacted by time, left the thinly layered shale characteristic of the Finger Lakes area. You can see it along roadside gulleys and in cavernous gorges where it sometimes peels off like layers of earth's skin. Barges stacked with sheets of this shale travelled the new Erie Canal in the mid-1800s to pave Brooklyn sidewalks.

Laced with fissures and easily split, the shale underlying Finger Lakes vineyards fulfills two important requirements of grapevines. It lets their roots probe deep into the mineral resources that infuse wine with nuance. And it keeps the soil well drained. Grapevines suffocate in soggy soil.

As the sea receded, evaporating water left salt beds and deposits of marine animal shells and decayed organic matter. Today the salt is mined from shafts burrowing underneath the lakes. The shell and organic deposits are also mined, by vine roots flourishing in soil rich in calcium (lime). These high-lime soils predominate in the lower-altitude environs of the big lakes: Seneca and Cayuga.

Not all grapevines do well in high-lime soil. Native-American varieties (Concord, Catawba, Niagara) like more acidic soil, hence the early Finger Lakes vineyards tended to stay around Keuka and Canandaigua Lakes. But European vinifera varieties prefer high-lime soil. Gold Seal winemaker Charles Fournier knew this well from his early years in France's Champagne district, where the soil is white with lime. Although his winery was on Keuka Lake, Fournier initiated the shift of Finger Lakes winemaking eastward to higher-lime soils when he planted what is still the region's largest vinifera vineyard on the east shore of Seneca Lake in the early 1970s.

THERE IS AN AXIOM in German wine country that the best vineyards can see water (the Rhine River or its tributaries). The same holds true in the Finger Lakes, for reasons that trace back to the last ice age.

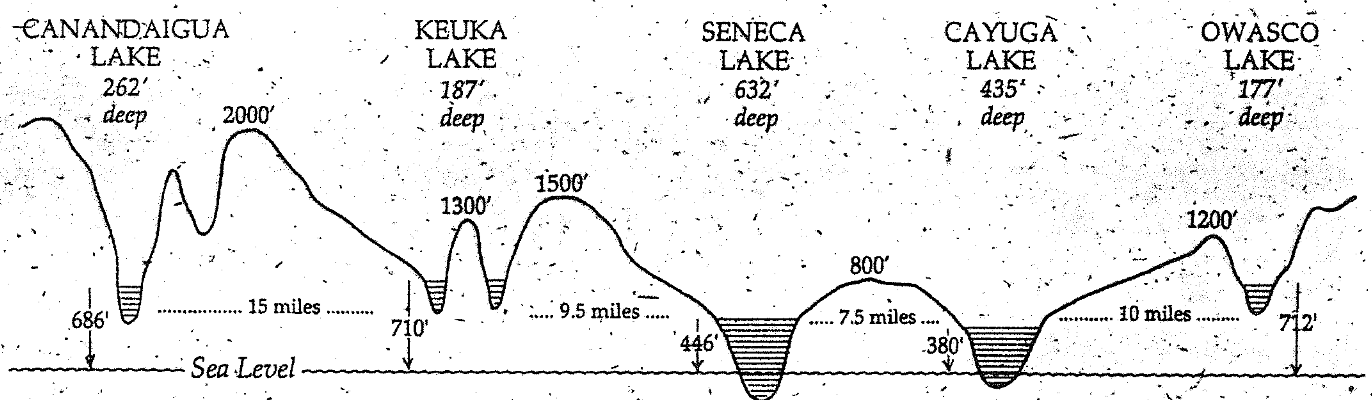
At that time, long after the inland sea was gone, the gently rolling terrain of central New York held rivers flowing south, parts of what we now know as the Delaware and Susquehanna River systems. The sling-shot shape of Keuka Lake records the confluence of two tributaries. When ice sheets advanced across this terrain, glaciers were funneled into the river valleys, concentrating the force of half-mile-thick chisels of ice.

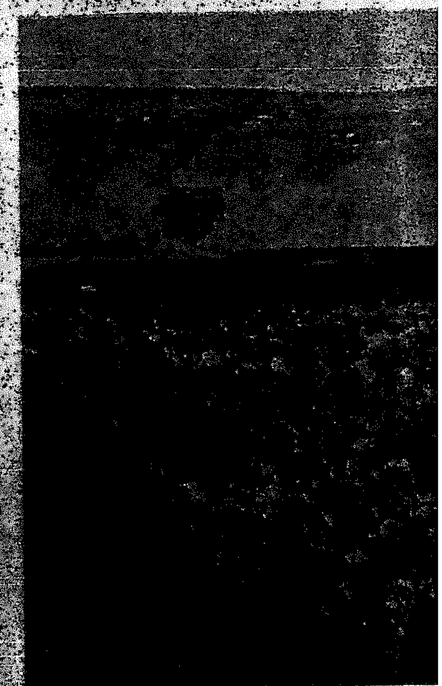
The glaciers repeatedly advanced, melted back, then advanced again, each time gouging deeper chasms in the river beds. Ten thousand years ago the last glaciers dropped enormous quantities of rock debris at their furthest reach south, plugging the ancient river valleys. As the ice sheets melted back, water filled the chasms to form a series of narrow, parralel lakes.

The Finger Lakes are extraordinarily deep. The bottoms of Seneca and Cayuga drop well below sea level. Narrow slices of water with relatively little surface area, they tend to maintain a stable temperature throughout the year. Surface water temperatures do shift with the seasons, but at a depth of 200 feet, for example, the water temperature of Seneca Lake stays 37° F. year-round. This causes the lake to act as a collosal radiator in the winter months. Seneca and Cayuga Lakes have frozen over, briefly, only a few times during each of the last two centuries. They remain open water, radiating heat, even as the nearby Great Lakes freeze.

Not only do the lakes take the edge off frigid upstate winters, often keeping vineyards 10-15° warmer than locations just a half mile away, but they also cushion the transitions of spring and fall. On the first hot days of April and May, the cooling influence of nearby water tends to delay the emergence of tender new vine shoots until the risk of damaging spring frosts has passed. In fall the effect reverses: summer heat stored in the surface layers of the lakes radiates up to ripening grapes, postponing first frosts until as late as November.

Distinct microclimates along the hillsides rising from the lakeshores make it possible to reliably ripen grapes in a region that is generally too cold for viticulture and certainly too cold for delicate European vines like Chardonnay and Pinot Noir.





The way in which the lakes warm
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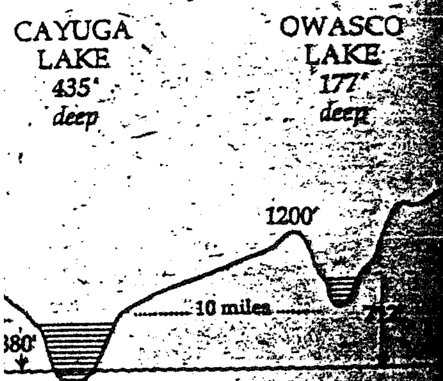
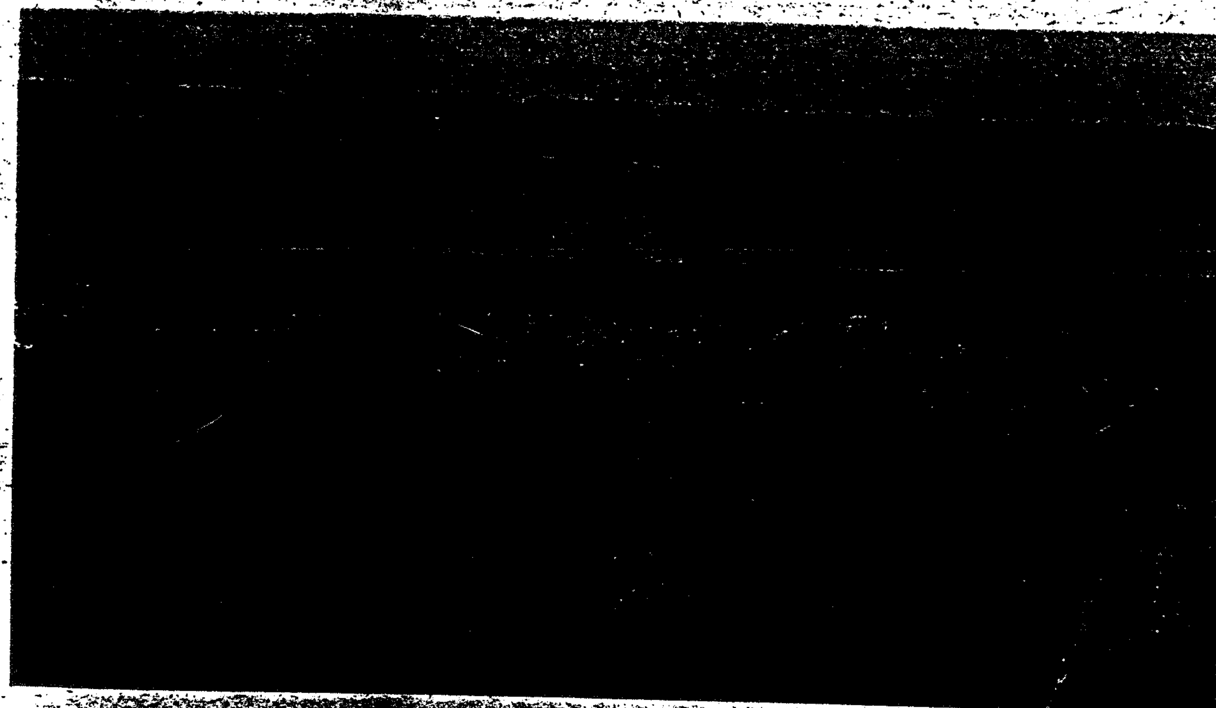
certainly too cold for delicate
ke Chardonnay and Pinot Noir.





The way in which the lakes warm surrounding vineyards becomes graphically visible on a cold, clear fall morning, when dense clouds hover over the lakes. Heat rising from the water is trapped in the valley by cold air above. The moisture in the warmer air forms a cloud bank, just as your warm breath becomes visible on a cold day. The difference in air temperature between vines at the foreground of this picture and the last vine row visible in front of the cloud may be 10°F, dramatically accellerating the ripeness of grapes close to the lake. In the depths of winter those ten degrees can also make the difference between life and death for dormant grape buds.

covered the areas. One early (1778) traveler to this region describes the soil's upper layer as composed of 8 to 10 inches of black organic loam. This was undoubtedly a great boon to the earliest agriculturists but one soon lost due to erosion and oxidation.

The northern portions of Seneca Lake's basin contains moderately coarse-textured soil with calcareous substrata. These soils are typically the Howard, Langford, Valois and Honeoy-Lima soils. Southward these give way to complex assemblages of more acid, less well drained types such as Volusia and Mardin-Lordstown. The combination of steeper topography and soils less well suited to many types of agriculture in the south compared with better buffered, better drained soils on less steep topography northwards is strongly reflected in land use patterns and in the price of farmland. (*Detailed soils mapping was prepared as part of this report and is available on the accompanying compact disk.*)

TOPOGRAPHY

Relatively flat topography at the north end of the Lake changes to rolling hills and then steep sided valleys, characteristically extending 900 - 1,000 feet below hill crests, to the south. The most conspicuous landform features are the Lake itself with an elevation of about 445 feet above sea level, and the carved rock channel gorges of east-west tributaries and their associated series of waterfalls. (*See Figure 3.7.*). The Lake has a smooth, regular shoreline. Irregularities that do occur are small and result from flat deltas built by tributary streams and wave action. The surface to bottom slope is steep, averaging nine percent.

CLIMATE

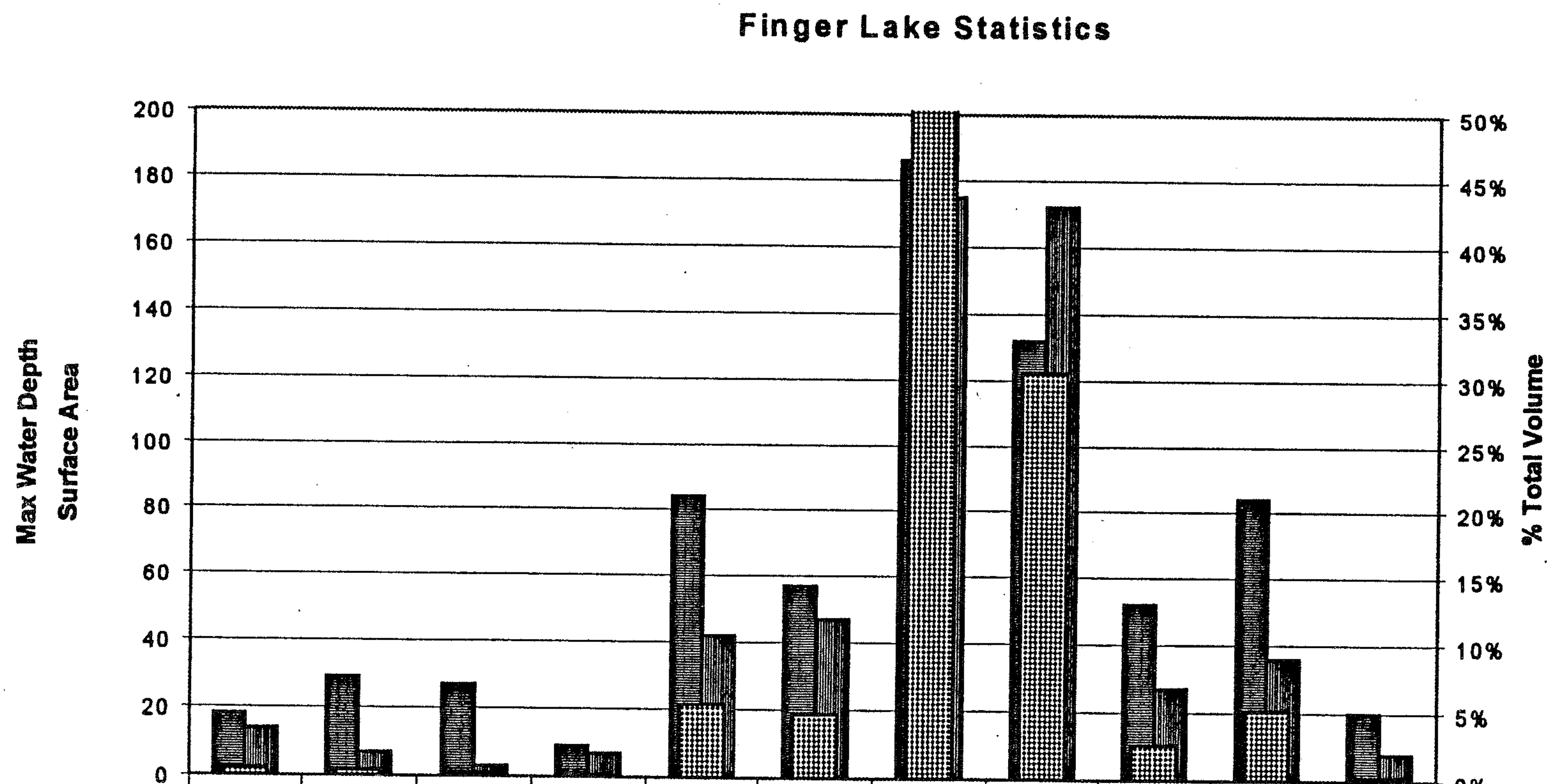
The Finger Lakes climatic region is characterized by cold, snowy winters and warm, dry summers although major flooding events may occur at any time, usually the product of tropical storm remnants entering the region from the south. At the extreme, flooding has been known to raise the Lake level to a maximum of 450.2 feet. As a whole, the central Finger Lakes is one of New York State's driest regions; however, precipitation is adequate to support most horticulture, especially that of deep rooted plants such as grapes.

Average precipitation for the region is about 34 inches per year with the smallest amounts in the December to March period. Winter snowmelt commonly occurs in late March - early April. Air temperature is normally distributed about a July average maximum of 69 degrees Fahrenheit and a 24 degree average minimum in January. From the mid-nineteenth century to early twentieth century local records indicate that Seneca Lake froze over during February-March on four different years. Since 1912, ice cover has apparently occurred only in localized, near shore areas.

VEGETATION

Prior to the American War of Independence, the land in the Seneca Lake basin was covered in virtual entirety by a closed canopy of mixed northern hardwood and softwood trees. Two early travelers through the Finger Lakes region independently described walking for four days without ever being able to observe the sky. Following the massacre and dispersal of

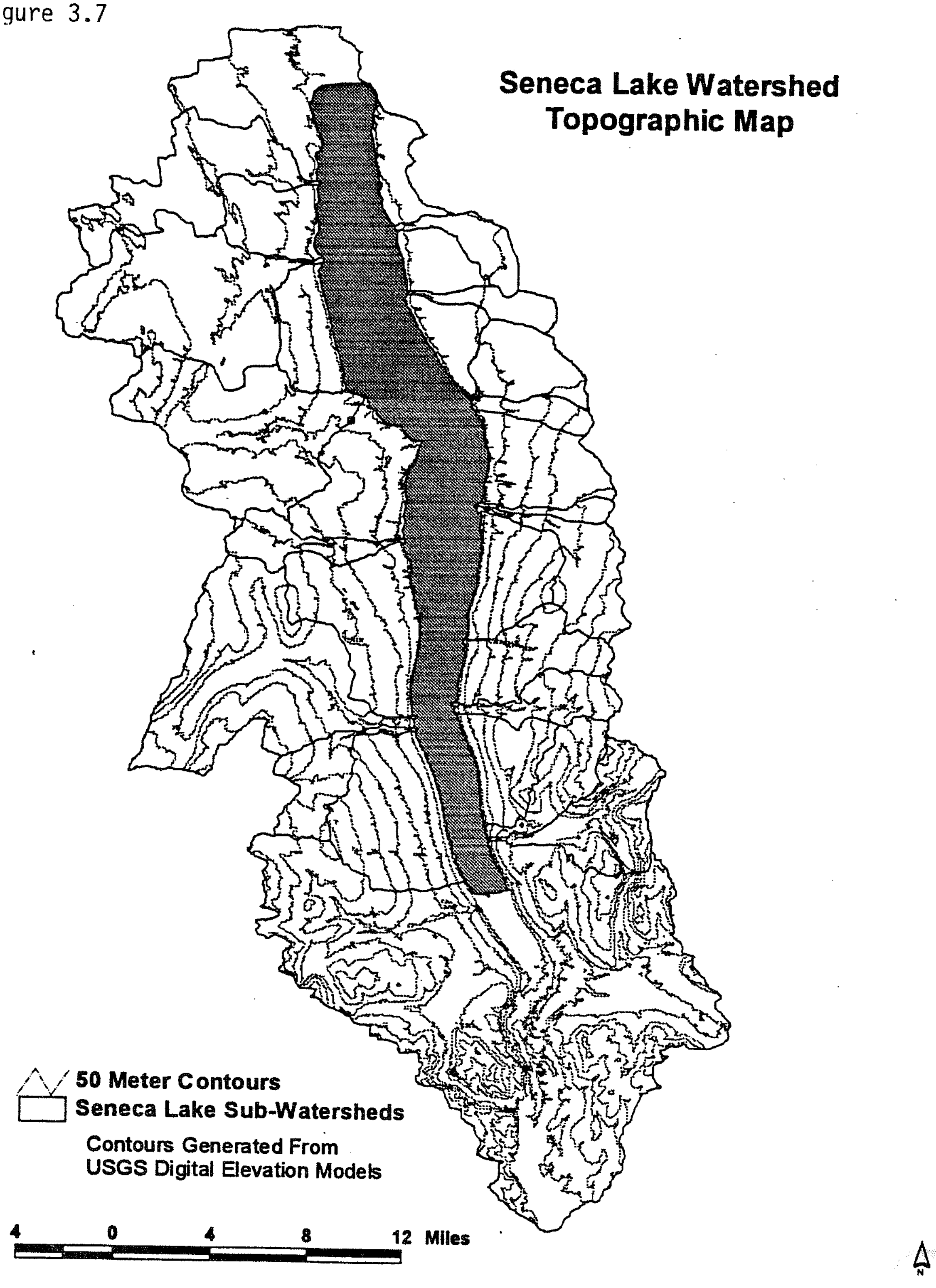
Figure 3.4 Finger Lakes Statistics.



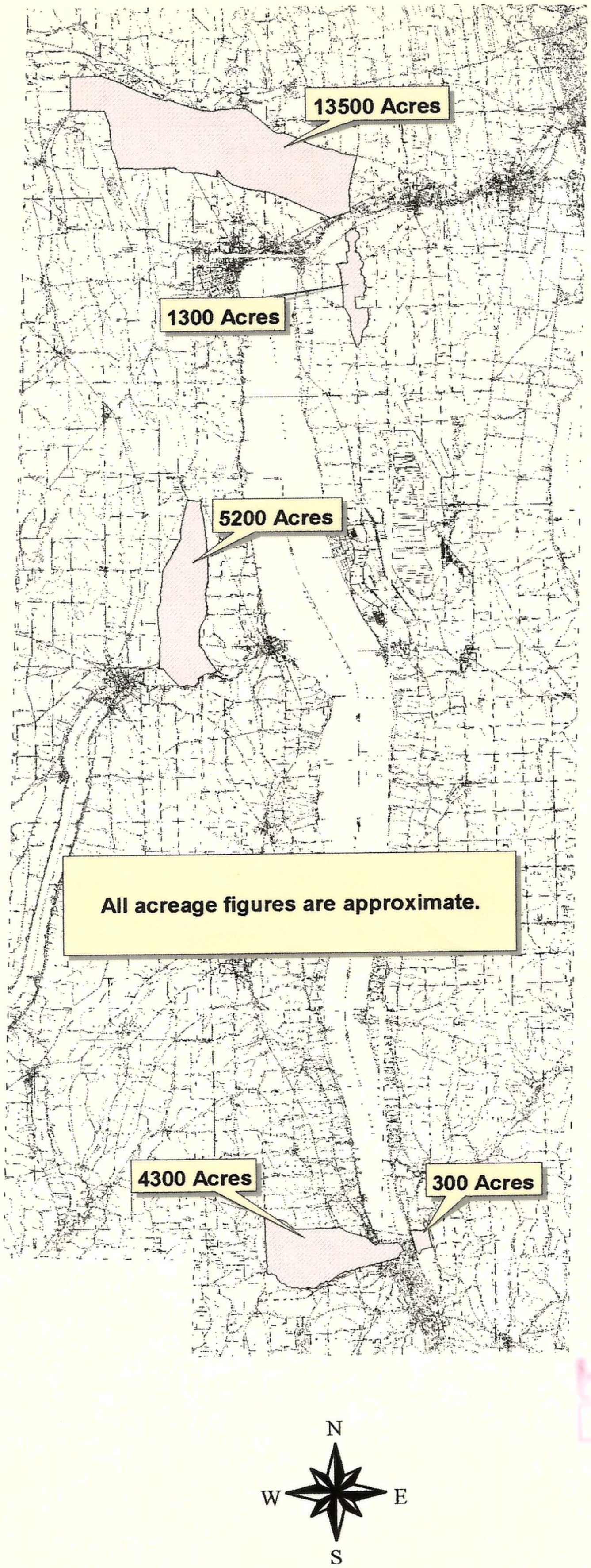
	Conesus	Hemlock	Canadice	Honeoye	Canandaigua	Keuka	Seneca	Cayuga	Owasco	Skaneateles	Otisco
Max Water Depth (m)	18	29	27	9	84	57	186	132	52	84	20
Surface Area (km2)	14	7	3	7	42	47	175	172	27	36	8
% Total Volume	0.51%	0.34%	0.14%	0.11%	5.33%	4.66%	50.53%	30.49%	2.54%	5.08%	0.25%

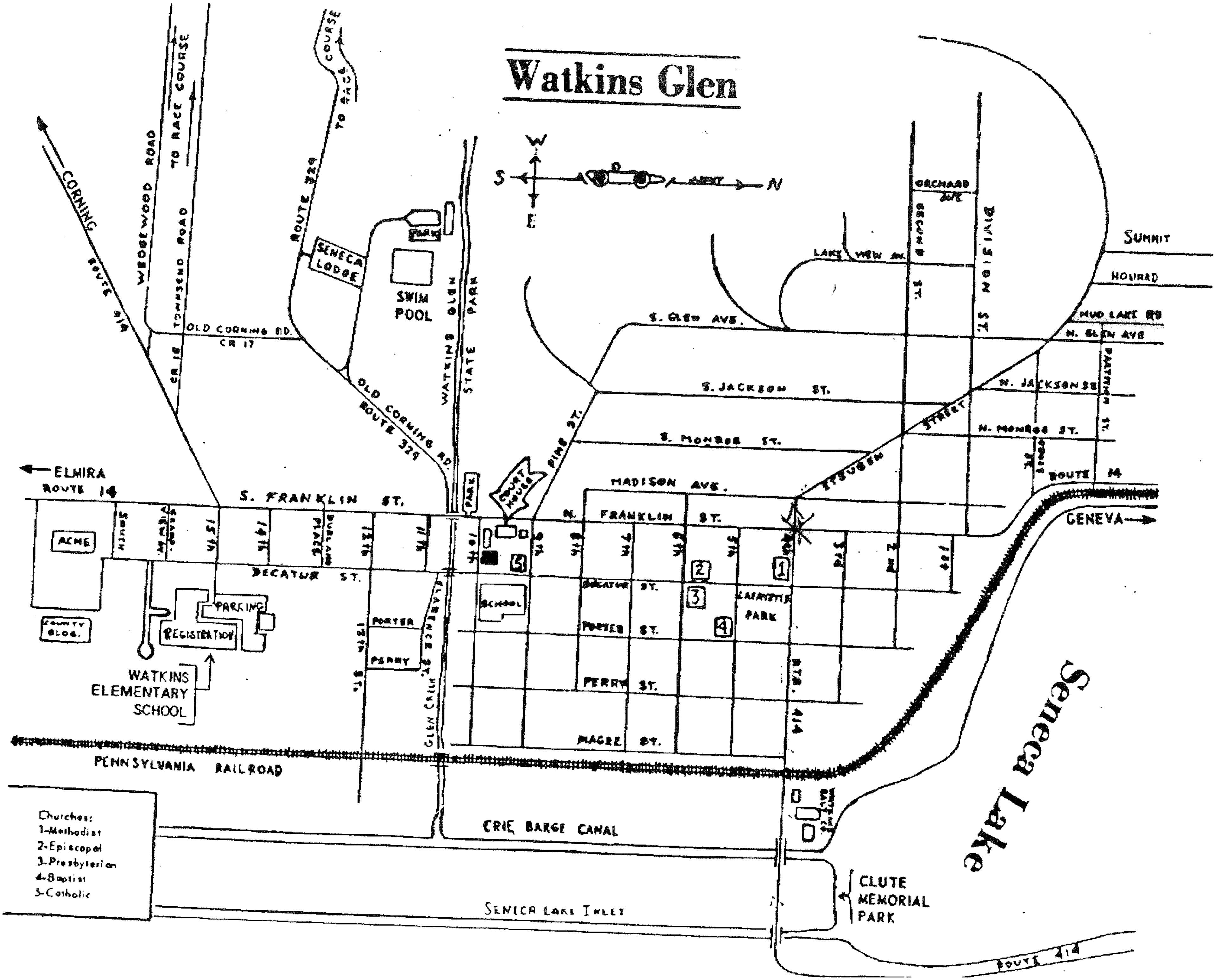
Max Water Depth (m) Surface Area (km2) % Total Volume

Figure 3.7



Seneca Lake Watershed
Topographic Map
50 Meter Contours
Seneca Lake Sub-Watersheds
Contours Generated From
USGS Digital Elevation Models
4 0 4 8 12 Miles
N


13500 Acres
1300 Acres
5200 Acres
All acreage figures are approximate.
4300 Acres
300 Acres
N
W
E
S


Watkins Glen
W
S
E
N
CORNING
ROUTE 414
WEDGEWOOD ROAD
TOWNSEND ROAD
TO RACE COURSE
TO RACE COURSE
ROUTE 329
SENECA LODGE
SWIM POOL
PARK
WATKINS GLEN STATE PARK
OLD CORNING RD.
CR 17
CR 18
OLD CORNING RD.
ROUTE 329
ELMIRA
ROUTE 14
S. FRANKLIN ST.
N. FRANKLIN ST.
COURT HOUSE
PINE ST.
MADISON AVE.
S. MONROE ST.
S. JACKSON ST.
S. GLEN AVE.
ORCHARD AVE
LAKE VIEW AV.
SECOND ST.
DIVISION ST.
SUMMIT
HOWARD
MUD LAKE RD
N. GLEN AVE
N. JACKSON ST
N. MONROE ST.
STEUBEN STREET
ROUTE 14
GENEVA
ACME
DECATUR ST.
DECATUR ST.
PORTER
PERRY
PORTER ST.
PERRY ST.
MAGEE ST.
SCHOOL
LAFAYETTE PARK
PARKING
REGISTRATION
COUNTY BLDG.
WATKINS ELEMENTARY SCHOOL
GLEN CREEK
RTE. 414
PENNSYLVANIA RAILROAD
ERIE BARGE CANAL
SENECA LAKE INLET
CLUTE MEMORIAL PARK
ROUTE 414
Seneca Lake
Churches:
1-Methodist
2-Episcopal
3-Presbyterian
4-Baptist
5-Catholic

New York Wine Industry Fact Sheet

RANKING:	Second largest wine producer in the U.S.
PRODUCTS:	Table wines, sparkling wines, dessert wines, wine coolers
VOLUME:	30 million gallons average annual production (Finger Lakes 85%, Hudson River 10%, Other 5 %)
WINERIES:	125 Statewide (Finger Lakes- 58, Hudson River Region- 28, Long Island- 24, Lake Erie- 8, Other- 7)
GROWTH:	106 wineries established since Farm Winery Act of 1976
AVERAGE CRUSH:	70,000 tons of grapes from over 1,000 growers
GROSS SALES:	Over $300 Million
EXCISE TAXES:	Over $30 Million to Federal and State Governments
EMPLOYEES:	About 2,000 at wineries; about 12,000 in vineyards
TOURISTS:	Almost 900,000 annually
VITICULTURAL AREAS: *	From west to east

- **Lake Erie**: characterized by the temperature-moderating effects of Lake Erie, captured by the parallel Allegheny Plateau
- **Finger Lakes**: Characterized by the "lake effect" micro-climates along several of the glacier carved Finger Lakes, the "air drainage" of sloping hillsides and glacial soils conducive to drainage.
- **Cayuga Lake**: characterized by temperature-moderating effects created by increased "air drainage" due to steep valley slopes and the release of heat stored in Cayuga Lake.
- **Hudson River Region**: characterized by the temperature-moderating flow of the Hudson River and the northward channeling of maritime breezes from the Atlantic Ocean.

New York Wine & Grape Foundation

- **The Hamptons, Long Island**: (the south fork of Long Island), characterized by the temperature moderating effects of the Atlantic Ocean and the prevalent sandy-loam soil.
- **North Fork of Long Island**: characterized by the long growing season and unique micro-climate produced by Long Island Sound and Great Peconic Bay

* As established by the Federal Government.

Viticultural Areas of New York State

Summary (1997)

Area	*Established*	*Square Miles*	*Acres of Vineyard*	*Bonded* Wineries*	*Growing Season*	*Unique Attributes*
LAKE ERIE	11/21/83	3,495	18,900	7 (1)	200	Plateau Lake Effect Soil
FINGER LAKES	10/1/82	4,000	10,400	51 (7)	190	Topography Lake Effect Soil
CAYUGA LAKE	4/25/88	N/A	460	10 (4)	200/205	Topography Lake Effect Soil
HUDSON RIVER REGION	7/6/82	3,500	500	22 (6)	180/196	River Valley Soil
NORTH FORK OF LONG ISLAND	10/10/86	159	1,500	19 (2)	233	Penninsula Ocean Effect Soil
THE HAMPTONS, LONG ISLAND	6/17/85	213	100	2 (1)	215	Penninsula Ocean Effect Soil

Notes:

"Viticultural Areas"—The Federal Government (Department of the Treasury, Bureau of Alcohol, Tobacco and Firearms) considers and approves "viticultural areas" similar to the "appellations of origin" in France, which may be used on wine labels and in advertisements.

"Growing Season"—indicates the annual average of days between spring and fall freezes which could adversely affect the cultivation of grapes.

Not all New York wineries are located within a designated viticultural area. The first number indicates the number of wineries physically located within the officially designated are. The number in parentheses indicates wineries generally categorized with this region, but not physically located within the officially designated region.

Soils of New York State

I. Introduction

Any discussion of the soils of New York State would be incomplete without mention of the unique geological history of the region. The periods of continental glaciation covering much of North America thousands of years ago created most of the topography that makes New York State so ideal for grape growing today. The Great Lakes of Erie and Ontario, all of the Finger Lakes as well as most of Long Island were formed by the action of these continental glaciers. Topography, along with the parent material from which a soil is derived, determine to a great degree a soil's characteristics and its suitability to agriculture.

New York State can be divided into 9 distinct physiographic provinces, or areas having similar parent material and geologic structure. They are the Long Island Province, the Archean Highland Province, the Taconic Province, the Catskill Province, the New York-Penn Province, the Lake Shore Plains Province, the Mohawk Valley Province and the Adirondack Province. Each of New York's grape growing regions is encompassed in a single one of these provinces with the exception of the Hudson River Region that encompasses or crosses five of these provinces. A discussion of the soil and physiographic characteristics of these regions follows.

II. Regional Soil and Physiographic Characteristics

A. Long Island

Long Island is encompassed in the physiographic province of the same name and is the result of a large moraine or hill of glacial deposits, or till, left by a receding continental glacier./ Because of the depth of this debris and the absence of bedrock as a source of parent material for soil, Long Island soils are unconsolidated, without a distinct structure. The north and south forks of eastern Long Island, the locale of nearly all the region's vineyards, are the results of outwash or gradual erosion of the moraine. These sandy, level soils are moist, well drained and deep, with a naturally high acidity and good physical structure. Years of agricultural use have elevated the soil pH and eliminated most strong acidic conditions. These soils qualify among the finest agricultural soils in the state, and are especially well suited to viticulture.

B. The Hudson River Region

This region crosses five physiographic provinces and is composed of more distinct soil types than any other region. Moving north from Manhattan, the first province encountered is that of the Gneissic Highland Province, a hilly, complex region of highly metamorphosed ancient gneiss. This region encompasses the northern end of Manhattan Island and southern Rockland County, where it forms the Ramapo Mountains. The region continues across the Hudson, and the structure underlies Westchester, Putnam and a small part of southern Dutchess County. The hardness of the bedrock in this area and glacial action have resulted in shallow, rocky soils largely unsuitable for agriculture. Bordering the Gneiss Highland Province to the north is the Taconic Province, an area of lower elevation that extends from Orange County northward through southeastern Ulster County and across the Hudson River, encompassing Dutchess, Columbia, Rensselaer and Washington counties. The rocks in this province are largely shales, slates, schists and limestones, although the northern and eastern areas of Dutchess, Columbia and Rensselaer are underlain with hard metamorphic quartzite and gneiss. The topography of this province varies widely, starting as a valley in southern Orange County and progressing to rolling hills and valleys in the western portions of those counties on the east side of the Hudson, finally culminating the rugged highlands of the Berkshire Mountains in the easternmost section of the province. Given the wide variety of parent material and topography in this province, soil types and suitability to viticulture are extremely varied. Soils in the western portion of this province generally tend to have moisture problems and be low in fertility, although many good sites of limited acreage are under cultivation as orchards and vineyards. Soil conditions improve on the western side of the Hudson, with eastern Dutchess and Columbia Counties possessing the finest sites and consequently the greatest acreage of vineyards. Deep, well-drained soils with adequate moisture holding capacity and low to moderate fertility are present and available in large tracts of land, and offer the opportunity for the expansion of viticulture in the Hudson Valley.

Two other physiographic provinces can be included in the Hudson River Region: the Catskill Province which borders the Taconic Province along the dramatic Shawangunk Ridge; and the Mohawk Valley Province which enters the region north of Albany. Neither are has significant acreage in grapes, and discussion of the soils of these areas is not relevant to this subject.

C. **The Finger Lakes Region**

The finger Lakes viticultural region is encompassed in the New York-Penn Province, or what is known as the Allegheny Plateau. This plateau, which has hill tops in the range of 1500 to 2000 feet, has been eroded and cut by streams and rivers over thousands of years and now resembles mountainous country with valleys and stream beds often 1000 to 1200 feet below the hilltops. The bedrock underlying the southern end of the Finger Lakes region is composed of alternating layers of sandstone and shale. In the northern end of the region the parent material is predominantly calcareous shale, which, being softer than the sandstone / shale combination, resulted in different soils and a slightly lower elevation. The agricultural suitability of the soils in this region follows this boundary precisely. Soils north of it, formed from calcareous shale, are deep, well drained, moist, fertile and are among the finest agricultural soils in the state. Soils south of the boundary are normally wet, poorly drained, highly acid and characterized by an impervious subsurface layer that impedes movement of water and root development. Thus agricultural lands bordering Lakes Seneca, Cayuga, Owasco and the northern end of Canandaigua Lake are generally better suited to viticulture than soils to the south such as those surrounding Keuka Lake.

D. **Lake Erie Region**

While grape growing in western New York is conducted in all three western-most counties (Chautauqua, Erie and Niagara), wine grape production takes place almost exclusively in Chautauqua county and is concentrated in a narrow band of land parallel to the shore of Lake Erie. Located on what was probably a glacial outwash terrace about a mile inland from the Lake, this series of loamy, deep, well-drained soils are also some of the best agricultural soils in New York State.

SOIL AND TEMPERATURE MAPS

New York State Mean Annual Temperature
New York State Growing Degree Days
Lake Erie Soil Map
Finger Lakes Soil Map
Hudson River Soil Map
Long Island Soil Map

Soil Map Legend

A	Areas where more than 60% of the soils are suitable for agriculture with no more than moderate limiting factors.
B	Areas where more than 60% of the soils are suitable for agriculture but most have severe problems of wetness, droughtiness, stoniness, depth or slope.
C	Most soils in these areas have serves problems of depth, slope, wetness, stoniness or droughtiness that greatly limit or prevent conventional agriculture.

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Soil use restricted by slope

Soil use restricted by wetness

Soil use restricted by droughtiness

Soil use restricted by depth

Water (lakes, rivers)

Clear areas, i.e. those lacking patterns, have no significant factors limiting their use in agriculture.

ROCHESTER
Democrat and Chronicle
MONDAY, NOVEMBER 15, 1999

YOUR LAND, OUR LAND: FINGER LAKES IN THE FAST LANE

AIMEE K. WILES staff photographer

Fall fun Honeymooners Brenda and Dick Harper of Pittsburgh play in autumn leaves after visiting Belhurst Castle, an inn just outside Geneva on Route 14, during their stay on Seneca Lake. Area officials have plans in the works to attract more tourists by using its plentiful wineries and beautiful views to bill itself as "Napa Valley East."

Seneca Lake plans to cash in on nature

Economic needs spur area to wine and dine tourists

Beneath the calm of Seneca Lake — waves lapping at rocky shores, birds chirping in vineyard-draped hills — another sound is building: the jangle of cash registers.

This deep, cold, massive Finger Lake long has served the people around it, providing everything from fresh water, abundant fish and salt to a good climate for vineyards and ideal conditions for testing stealth ship technology.

Now, because of economic need, the lake is being called on to lure tourists with fat wallets.

As the Finger Lakes are recast as a major, wine-fueled tourist attraction, Seneca Lake will play a starring role. Imagine boats touring the Erie Canal and parking at Geneva's multimillion dollar waterfront district. And a new Finger Lakes Interpretive Center celebrating the region's history and attractions.

The plans are ambitious — and perhaps overdue.

"We are probably one of the most underutilized regions in the Northeast," said Spike Herzig, director of the Penn Yan-based Finger Lakes Association, a sort of Chamber of Commerce for the region. "Just now are the Finger Lakes beginning to come into their own."

Yet as those lakes, especially Seneca, gear up for tourism, some have concerns about potential harm to the lake. The growing winery business has added pollutants to the water. And one organization is compiling a study of Seneca Lake that will help define a healthy level of tourism.

Indeed, many see the tourism and visitor trade as a way to ensure the health and beauty of the lake.

Eventually, the Finger Lakes could become like the Adirondacks or California's Napa Valley — a tourist destination that needs no explanation, said Schuyler County Chamber of Commerce President Margaret Cook.

Seneca Lake is one of the most captivating of the 11 Finger Lakes. Named after the Iroquois Nation people who lived along its shores hundreds of years ago, it is

SENECA, PAGE 8A

Big plans Marie Ehler, a member of the Schuyler County Chamber of Commerce, stands on the Watkins Glen public pier at the southern tip of Seneca Lake. The chamber has been very involved in the Watkins Glen waterfront revitalization, raising money for improvements.

About This Special Report

This is the sixth in a series of reports on the 11 Finger Lakes. The series is part of an ongoing investigation of the effect of development on our region.

Today, we examine Seneca Lake, which aims to become a tourist hub. Moving eastward, we will report on Cayuga, Owasco, Skaneateles and Otisco lakes next month.

Seneca

FROM PAGE 1A

surrounded by striking views, from Watkins Glen State Park to the cascades at Montour Falls and Hector Falls. Seneca Falls, the birthplace of the women's rights movement, is nearby. So is Watkins Glen International speedway.

Unlike the more developed Finger Lakes, Seneca still has more cornrows than cottages, more grapevines than gas stations. Less than 10 percent of its watershed area is developed; the rest is forests, fields and farmland.

The rocky cliffs lining much of the lake discourage construction along the shore. Also preserving the lake's rural character is its distance from any major population base.

"If we were closer to Rochester or Syracuse," said John Halfman, geoscience professor with Hobart & William Smith Colleges in Geneva, "we'd be a huge tourist draw."

Only now, after extensive marketing and tourism pushes earlier this decade, is the area starting to bubble with tourist dollars.

More than anything else, Herzig said, wineries "are the hook to get people here."

Pure, deep, salty

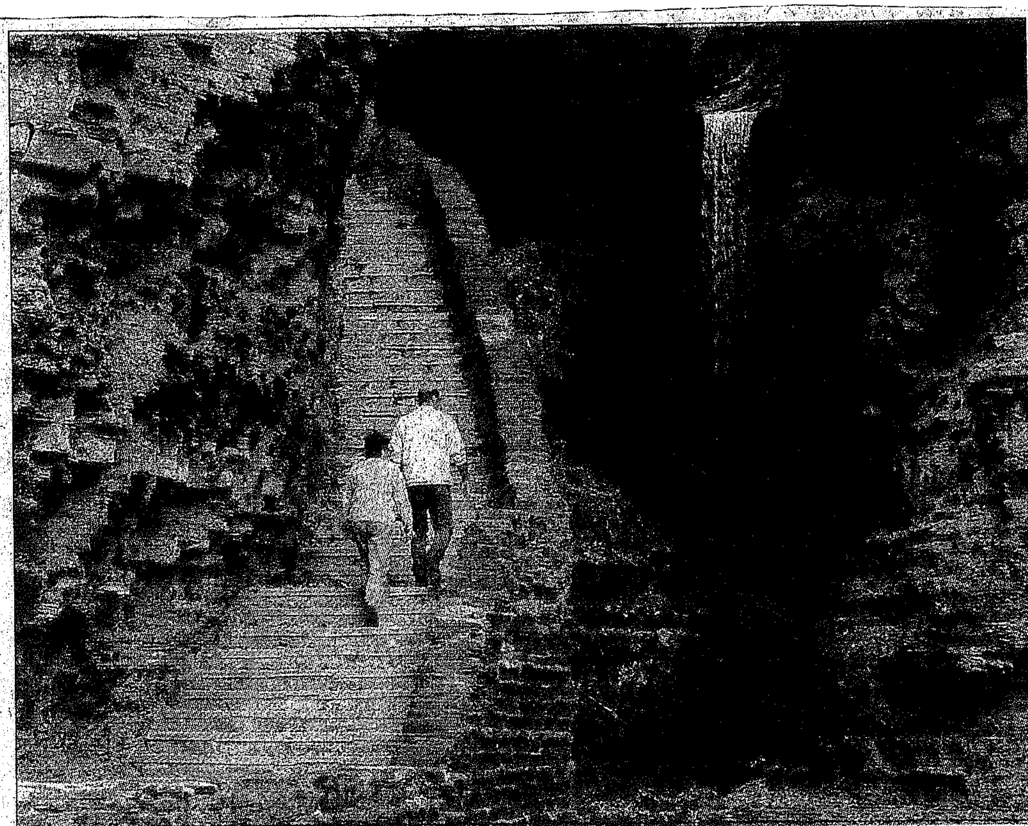
Go to the shore of Seneca Lake. Cup a handful of the cold, clear water. Drink it without hesitation.

"It's some of the best water around," Halfman said.

Some 70,000 people get their water from the lake. The seven water treatment plants around the lake do little to make the water drinkable, Halfman said — a little fluoride, a little filtering, voila.

More a forearm than a finger, Seneca is the deepest of the 11 Finger Lakes; its 4.2 trillion gallons of water make up more than half of the water in the lakes as a whole.

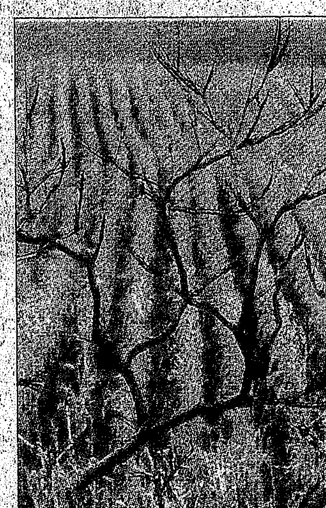
Vineyards love the lake because it keeps the surrounding area moist and temperatures



AIMEE K. WILES staff photographer

High road Mary Macy and Gary Schramm of Buffalo climb hundreds of stone steps on a tour of waterfalls during their visit to Watkins Glen State Park. The striking views are part of the beauty of Seneca, one of the most captivating of the 11 Finger Lakes.

Sweet site At the Fox Run vineyard on the west side of Seneca Lake, grape leaves turn red and gold in early November after the harvest season. Officials expect wineries will attract more and more tourists.



Bumper crop Rows of golden cornstalks, already harvested of their ears, complement the vineyards along Route 14 on the west side of Seneca Lake.

moderate. The United States military loves the lake because it is so quiet and so deep. Since 1960, the Naval Undersea Warfare Center has kept a sonar test facility in Dresden, where the United States and allied nations test ship and submarine designs to see how well sonar will pick them up.

Some 130 tributaries plus Keuka Lake drain into Seneca. Springs at the bottom of Seneca also feed it. Water flows from Seneca Lake into the Cayuga-Seneca Canal, then into Cayuga Lake, then into the Seneca River and eventually into Lake Ontario.

But other things flow into Seneca Lake.

It is by far the saltiest of the Finger Lakes. The glaciers that formed those lakes dug Seneca so deeply, lake water percolates through the same underground salt layer that's mined by two salt companies at the lake's south end.

The salt concentrations don't pose a health risk, but infants and people on salt-free diets might want to beware, Halfman said.

A more troublesome element in the water is simazine. The pesticide, used often in orchards and vineyards, is found in somewhat high levels in Seneca Lake waters, although well below health advisory levels. The U.S. Geologic Survey, which did a 1997 study detailing the simazine levels, plans more testing to track the problem.

Despite the simazine issue, many environmentalists welcome the growing winery trade around the lake.

"I would prefer a vineyard to a factory, just aesthetically to start with and also for the byproducts involved. A vineyard is sort of a natural system," said Irene Brown, chairwoman of the Finger Lakes Land Trust, Seneca chapter. "They do a fairly good job of preventing erosion. The tourist trade, we're very happy to have it. It's a noninvasive type of business. They bring money in and lay it at our feet, and we're very grateful."

One nonprofit group, the Seneca Lake Pure Waters Association, is working to preserve the lake's water quality. The Geneva-based group works with the many municipalities in Seneca's 537-square-mile watershed: 11 villages, 28 towns, one city and five counties — Ontario, Seneca, Yates, Schuyler and Chemung.

The group is putting together a "state of the lake" thing from its water quality to local economic trends. Once that information is in hand, said association Executive Director Marion Balyszak, planning on the lake's future can begin.

"There's not an emergency situation, which is good for the lake," Balyszak said. "You're not trying to put out a fire; you're doing something proactive that would preserve what's already there."

Riding the storm

"Lake Trout Capital of the World," boasts a billboard just outside Geneva.

Early each spring, fishermen flock to the shores of Catharine Creek at the lake's south end to snag rainbow trout heading upstream to spawn. Every Memorial Day, 3,000 anglers from around the nation crowd the lake for its renowned trout derby.

The lake also is known for its yellow perch and smallmouth bass, said David Kosowski, aquatic biologist with the New York state Department of Environmental Conservation.

But the last couple of decades have been tough on the fish. The lake "is in a state of change right now," Kosowski said, as waves of foreign species infiltrate, usually through the Cayuga-Seneca Canal, which connects the lake to the New York state Barge Canal System at the north end.

Sea lampreys — eel-like parasites with round, tooth-filled mouths — showed up up in 1982 and attacked the native fish population in Seneca Lake the same way they destroyed a number of Great Lakes fisheries years earlier. Now every three years, the state dumps pesticides into tributaries feeding the lake. "We can't get rid of them, but we can knock them down," Kosowski said.

In 1992, zebra mussels arrived. Now they jeopardize the trout — ironically, by helping them. The trout population took a nosedive after 1972's Hurricane Agnes dumped silt and mud over the rock and rubble at the lake bottom, leaving trout no place to lay their eggs. Since then, the state has had to stock the lake with trout.

But now the trout population is booming because all the zebra mussels lining the lake bottom are serving as a good nesting place for lake trout eggs. But with the soaring population, said Kosowski, "lake trout are eating them-

Tasty times Chad Bond, center, a bartender at Fox Run vineyard, serve wine to David and Una Connelley during an afternoon of wine-tasting. The mother and son were visiting the Finger Lakes from Ireland last month.

This summer, a type of Baltic-area water flea — cercopagis pengoi — made its debut in the lake. The bane of fishermen, the water fleas breed in August, gathering in clumps that gum up fishing reels.

The lake "is in a big state of flux right now," Kosowski said. "It's going to take time for things to even out. We can only do so much and ride the storm."

Fruit of the vine

Tricia Murphy and her husband traveled from their home in Branson, Mo. — a major country-music tourist destination — to tour the Seneca Lake area last month.

"We love it, it's so pristine and rural," she said as she sampled the 1998 Niagara at Torrey Ridge Winery.

"It's not at all what I had the concept of upstate New York to be," she said, adding that she planned to return.

The Yates County winery, on the lake's west side, opened in mid-September, an offshot of Earle Estates Meadery and Earle Estates Winery.

"Every year, we see more and more people," co-owner Esther Earle said.

The 26 wineries along Seneca Lake are seeing as much as 10 to 20 percent customer growth each year, said Barbara Adams, director of the Seneca Lake Wine Trail, a winery-sponsored tourism group. "It's booming."

The concern now is to not overdo the tourism, said Adams. "I don't want us to turn into a tourist-trappy place."

But the biggest tourism problem now, she said, is the dearth of hotels and restau-

To that end, Glenora Wine Cellars, one of the oldest and biggest wineries on the lake, cut the ribbon earlier this year on a $6 million restaurant and 30-room inn addition.

The ultimate goal is to make Glenora — already one of the most marketed of the upstate wineries — a "must-see destination," said Glenora Vice President of Operations Ray Spencer.

Many people, he noted, already refer to Seneca Lake as "the Napa Valley of the East."

Building, balancing

Blacktop and solid yellow lines covered the northern shore of Seneca Lake for much of the 20th century.

In the late 1980s, to jump-start a depressed local economy, Geneva and the state and federal governments spent $9 million moving Routes 5 and 20 away from the shore, opening up a 60-acre crescent of land between the new road and the water.

A $13.5 million, 148-bed Ramada Inn, which opened in June 1997, is the anchor for further waterfront development, said Richard Rising, Geneva's director of planning and economic development.

Now the city is working on a shopping list of plans for the land: developing a marina near the hotel; renovating a long pier for foot traffic; creating a commons area for festivals; and attracting a private office building. The work hinges on state and federal grants and loans.

The city's goals are to rejuvenate the community and downtown, and to boost Geneva's visitor and tourism trade, Rising said. "We're real-

Seneca Lake

It's pronounced "SEN-ih-kuh."

Length: 38 miles.

Maximum width: 3.2 miles (1.9-mile average).

Maximum depth: 632 feet.

Volume of water: 4.2 trillion gallons.

Length of shoreline: 75.4 miles.

Size of watershed: 537 square miles (41,509 acres).

Primary uses: Source of drinking water for 70,000 people. It's becoming a major tourist attraction because of its superb fishing, 26 wineries and the Watkins Glen International raceway. The Naval Undersea Warfare Center has a sonar test facility here. A pair of salt companies mine a salt bed at the lake's south end. The watershed area is predominantly farmland and forests.

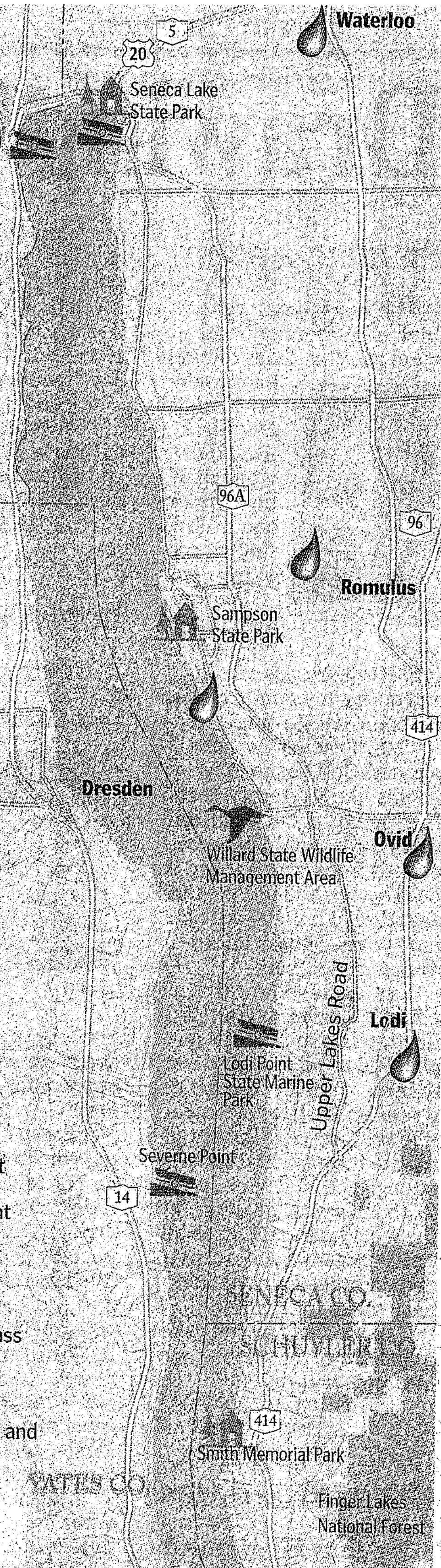
Problems: The lake suffers from the same foreign pests that plague the Great Lakes, such as zebra mussels and sea lamprey. This summer, the spiny water flea was first detected here. The pesticide simazine, used often in orchards and vineyards, has been detected in the water, although well below health advisory levels.

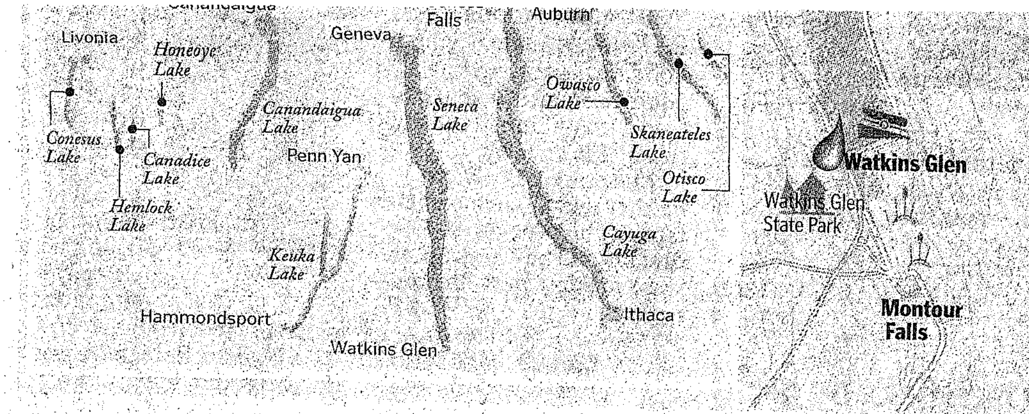
Assets: The deepest of the Finger Lakes, Seneca has more than one half the water of the entire chain. The water is clean and offers world-class fishing. The watershed is less developed than many of the other Finger Lakes because of Seneca's remoteness and its cliff-studded shoreline. And the climate is excellent for vineyards.

Public access: The lake's north shore, in the city of Geneva, is open to the public, including Seneca Lake State Park and 60 acres of adjacent land owned by the city. Other public areas: Sampson State Park, on the lake's east side, 12 miles south of Geneva; Lodi Point State Marine Park, halfway down the lake's east side, west of the village of Lodi; Severne Point, on Severne Point Road off Route 14, halfway down the lake's west side; Smith Memorial Park, located off Route 414 at Hector; Watkins Glen, located off Route 414 on Catharine Creek; Willard State Wildlife Management Area, on the lake's east shore, southwest of Ovid. Finger Lakes National Forest is in the process of developing 60 acres it recently purchased on the lake's west shore.

Game fish: Known for its lake trout; smallmouth bass and yellow perch also are mainstays.

Water treatment plants:
Seven water treatment plants draw from the lake: Geneva, Watkins Glen, Ovid, Lodi, Waterloo, Willard and the old Seneca Army Depot.





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en our location and our access to the water."

Next to that 60-acre parcel is the site of the Finger Lakes Association's $5 million interpretive center. Construction is expected to begin in 18 months — if the association raises the money.

The center will feature information and displays on area tourist attractions and the history of the Finger Lakes region. Association president Herzig envisions area students also taking field trips to the center.

Meanwhile, at the lake's south end, Watkins Glen and Schuyler County also are trying to generate more bucks through tourism.

A renovated train station opened in Watkins Glen this year as a restaurant overlooking the lake. That has helped lasso more of the traffic that used to pass through town without stopping, said Schuyler County Chamber of Commerce President Margaret Cook. "It's really spurred things on."

A 13-room inn opened this year in Watkins Glen; another doubled its rooms.

A 64-bed hotel on the village's lakefront is slated to be built within the next two years. Within the next four years, a 12.5-mile hiking and biking trail could stretch from the village's waterfront into Chemung County.

"It's been difficult to get some people to invest in some projects," Cook said. "But now that it has started, it's only going to grow."

The village already relies on tourism money: Watkins Glen International raceway brings in 500,000 to 600,000 visitors a year, Cook said; the state park, about 750,000.

The concern now is making sure tourism grows in a way that doesn't harm the lake, said Balyszak, of the Pure Waters Association.

Development around the lake is not going unnoticed by residents. Alice and Reginald Lambert moved from Chili 10 years ago to the lake's west shore. When they built their retirement home, it was secluded. Today, it is one of two dozen homes within a few hundred yards of each other, each on a five-acre lot.

The winery traffic on Route 14 also has been picking up over the years. "We have a lot of limos coming through," Alice Lambert said.

But the couple doesn't begrudge the growth. "As long as the economy stays healthy, it's good for everybody," Reginald Lambert said.

"It's not my lake. I own a little slice of it, but it belongs to everybody — as long as they keep it clean." □

About this series

Today's report is the ninth in an ongoing project, "Your Land, Our Land: Growing and Saving the Rochester Region." Earlier installments examined: development's impact on Conesus and Honeoye lakes; the need to permanently protect Rochester's reservoirs, Hemlock and Canadice lakes; the gilding of Canandaigua Lake; efforts to preserve Keuka Lake; sprawl's toll on our region; Ontario County's boom; grass-roots push for "smart growth."

In the coming months, we will explore the other four Finger Lakes and zoning issues.

This series is available online at the *Democrat and Chronicle*'s Digital Edition: www.RochesterNews.com/extra

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To learn more

- **The Seneca Lake Pure Waters Association:** (315) 789-3052 or check out its Web site at www.home.eznet.net/~slpwa/SLPWA
- **The Finger Lakes Association:** (315) 536-7488 or check out its Web site at www.fingerlakes.org/fingerlakes/
- **The Schuyler County Chamber of Commerce:** (607) 535-4300or check out its Web site at www.schuylerny.com
- **The New York Wine and Grape Foundation:** (315) 536-7442 or check out its Web site at www.nywine.com
- **The Finger Lakes Land Trust:** (607) 275-9487, or its Seneca Chapter at (607) 387-6507.
- **The city of Geneva's Department of Planning and Economic Development:** (315) 789-4393 or check out its Web site at www.geneva.ny.us/
- **The New York state Department of Environmental Conservation:** Region 8 office, 226-2466.