

Conesus Lake

CHAPTER 3 THE NEED FOR RESTORATION AND PROTECTION

3.1 *The Nature of the Resource*

This section summarizes information contained in the May 2002 *State of Conesus Lake: Watershed Characterization Report*.

3.1.1 CURRENT USES: WATER SUPPLY, RECREATION, AQUATIC LIFE SUPPORT

Conesus Lake is truly a resource used by many people for many purposes. The lake is a source of water to approximately 15,000 Livingston County residents both within and beyond the watershed boundaries. As a recreational focus, the lake is used for swimming, boating, fishing, and aesthetic enjoyment. Residences ring the shoreline, and these properties must be protected from flooding. Constructed wetlands near the mouth of Conesus Inlet are managed to provide spawning habitat for northern pike and walleye. Water released from the lake serves to dilute the effluent from the Livingston County Water and Sewer Authority facility on the lake outlet, Conesus Creek, and to help prevent harmful effects on the downstream biological community.

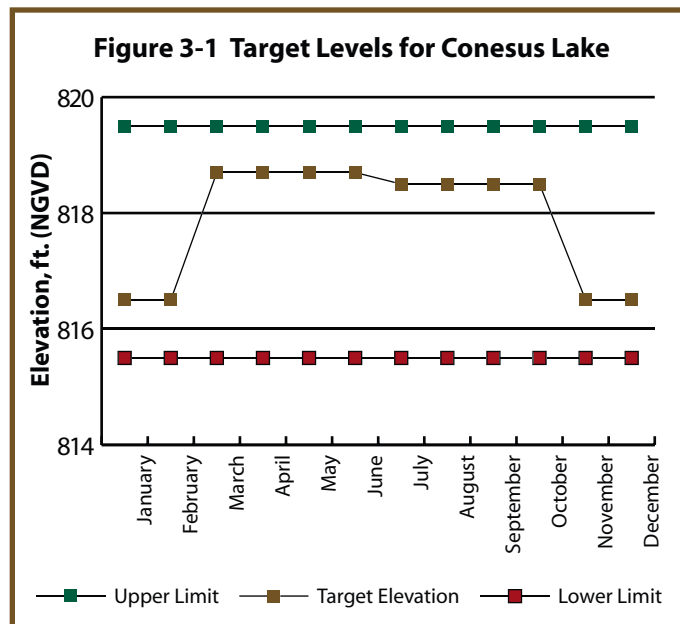
Current uses of Conesus Lake are threatened by a myriad of problems caused by a combination of natural conditions and human activities. Actions are needed in the watershed to reduce pollutant runoff to the tributary streams and ultimately to Conesus Lake. Actions are also needed within Conesus Lake itself to reduce internal nutrient loading from the sediments, reduce the proliferation of nuisance aquatic plants, and shift the community of plants and animals towards a sustainable assemblage composed primarily of native species.

3.1.2 WATER LEVEL MANAGEMENT AND SAFE YIELD

A rule curve developed by the Army Corps of Engineers is used to manage water levels within maximum and minimum acceptable levels to protect multiple uses of the lake for water supply, flood control, fish and wildlife habitat, recreation, and downstream riparian uses including diluting treated wastewater and meeting the legal requirement for flow maintenance in the outlet stream. Monthly target lake levels are displayed in Figure 3-1.

The Conesus Lake Compact of Towns (membership includes the Towns of Livonia, Conesus, Groveland, and Geneseo) operates the control structure at the lake outlet and maintains water levels at 818.7 feet from March through June. During summer, lake level is targeted at 818.5 feet. This water level management strategy, coupled with the enhanced capacity to draw down the lake quickly, has reduced flooding of lakeshore property. In recent years, water levels have fluctuated in response to precipitation. However, summer lake levels tend to fall below targets.

NYSDEC completed a safe yield evaluation of Conesus Lake (NYSDEC 1994). The objective of



Source: Rule Curve - Army Corps of Engineers, 1991.

a yield study is to examine long-term precipitation records and calculate the volume of water that can be withdrawn from a lake or reservoir while maintaining water levels and downstream requirements. The safe yield is the maximum quantity of water that can be guaranteed during a critical dry period, defined as the drought of record. There is always a chance that drier conditions will develop.

Based on the NYSDEC analysis, the safe yield of Conesus Lake is approximately 7.8 million gallons per day (mgd). Current water supply permits allocate more than this amount; however, the actual withdrawals for public water supply are below their permit allocation (Table 3-1). The water suppliers could not consistently draw water to the level of their current allocation without increasing the capacity of the infrastructure used to draw, filter, disinfect, and distribute potable water to their customers. Any increase in capacity would require a revision to the public water supply permit and trigger a reanalysis of the lake's safe yield. Defining a sustainable level for drinking water withdrawal is an important element of a long-term management strategy for Conesus Lake.

Allocated Use	Permitted Withdrawal (million gallons per day)	Average 1999-2001 Withdrawal (million gallons per day)
Water supply: Village of Avon	3.5	0.7
Water supply: Village of Geneseo	3.0	1.16
Lakeville Water District	0.040	0
Downstream release requirement for wastewater dilution	6.5	As required
Summed Allocation	13	
Safe yield at 3 feet drawdown	7.8	
Deficit/over allocation	5.2	

Sources: NYSDEC, 1994; Villages of Avon and Geneseo

3.1.3 TROPIC STATUS

Lake trophic status is a continuum from nutrient poor (*oligotrophic*) to nutrient rich (*eutrophic*), with *mesotrophic* as an intermediate stage. Lakes are assigned to one of the three categories along this continuum based on four typical indicators: total phosphorus (P) concentration, chlorophyll-*a* concentration, water clarity as measured by Secchi disk transparency, and deep water dissolved oxygen (DO) levels. Levels of these indicators associated with oligotrophic, mesotrophic, and eutrophic lakes are summarized in Table 3-2 and compared with recent measurements in Conesus Lake.

Indicator and units	Trophic Status			Conesus Lake 2000
	Oligotrophic	Mesotrophic	Eutrophic	
Total P (µg/l)	< 10	10 – 20	> 20	22
Chlorophyll- <i>a</i> (µg/l)	< 4	4 – 10	> 10	8.8
Secchi disk transparency (meters)	> 4	2 – 4	< 2	2.5
Deep water oxygen (percent saturation)	> 80	10 – 80	< 10	< 5

Source: U.S.EPA 1974; Conesus data 2000 (Makarewicz et al. 2001)

Both historical and recent data indicate that Conesus Lake is eutrophic. Eutrophic lakes are well supplied with nutrients and support an abundance of algae and rooted aquatic plants. The deepest waters of eutrophic lakes typically become devoid of dissolved oxygen by late summer, as microorganisms use up oxygen to break down the organic material such as algal cells that rain down from the upper sunlit layers.

Phosphorus is naturally present in all waters and is an essential nutrient for life. It is the limiting nutrient for algal growth in Conesus Lake. Consequently, the Watershed Management Plan is directed at controlling phosphorus sources to the lake, and phosphorus cycling within the lake.

Algae and aquatic plants become a nuisance when their abundance causes lake water to appear green and unattractive for swimming, boating, and other recreational uses. Plants and algae can cause localized problems when they die and begin to decompose. The decomposition process may deplete dissolved oxygen levels, limiting habitat for aquatic life. Decaying plants and algae wash up onto the shoreline of Conesus Lake and create unpleasant odors.

Water quality conditions in Conesus Lake have been tracked for decades, thanks to long-term monitoring by regional colleges and NYSDEC. As

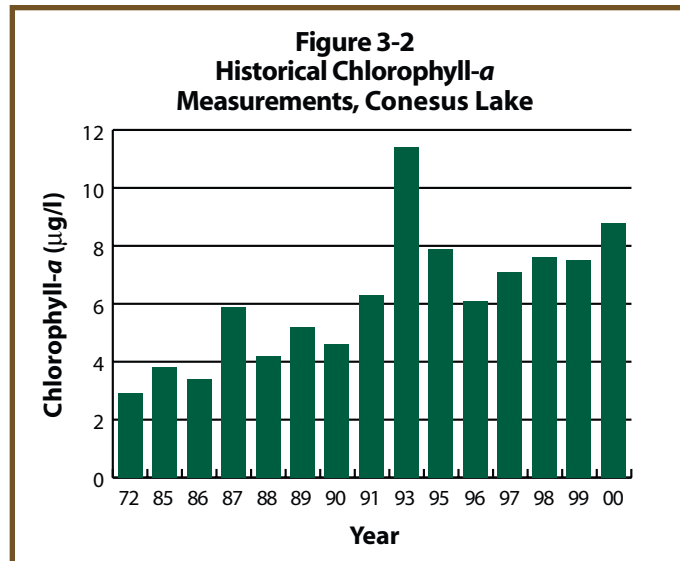
described in the Characterization Report, algal abundance is estimated by measurements of the plant pigment chlorophyll-*a*. When chlorophyll-*a* concentration exceeds about 6 µg/l, a lake appears less attractive for recreational use. Concentrations in excess of 13-15 µg/l are a definite impediment to recreational use. Historical and recent chlorophyll-*a* data (Figure 3-2) illustrate the increased algal abundance in recent years.

Excess algal growth in water supply reservoirs is also problematic; the efficiency of water treatment can be greatly reduced by algae that clog the filters. Certain algal species contribute to taste and odor problems in reservoirs. A high abundance of algae is associated with increased concentrations of organic compounds that, when chlorinated in the water treatment process, may create trihalomethanes (THMs). These are four chemicals formed along with other disinfection by-products when chlorine or other disinfectants used to control microbial contaminants react with naturally occurring organic and inorganic matter in water. The federal Environmental Protection Agency (EPA) and the New York State Department of Health (NYSDOH) regulate the maximum concentration of THM in drinking water to protect human health. Keeping algal abundance low is an important preventative measure. Currently, the Conesus Lake water supply is in compliance with maximum contaminant levels for THMs.

3.1.4 GEOLOGIC SETTING: VULNERABILITY DUE TO SOILS AND TOPOGRAPHY

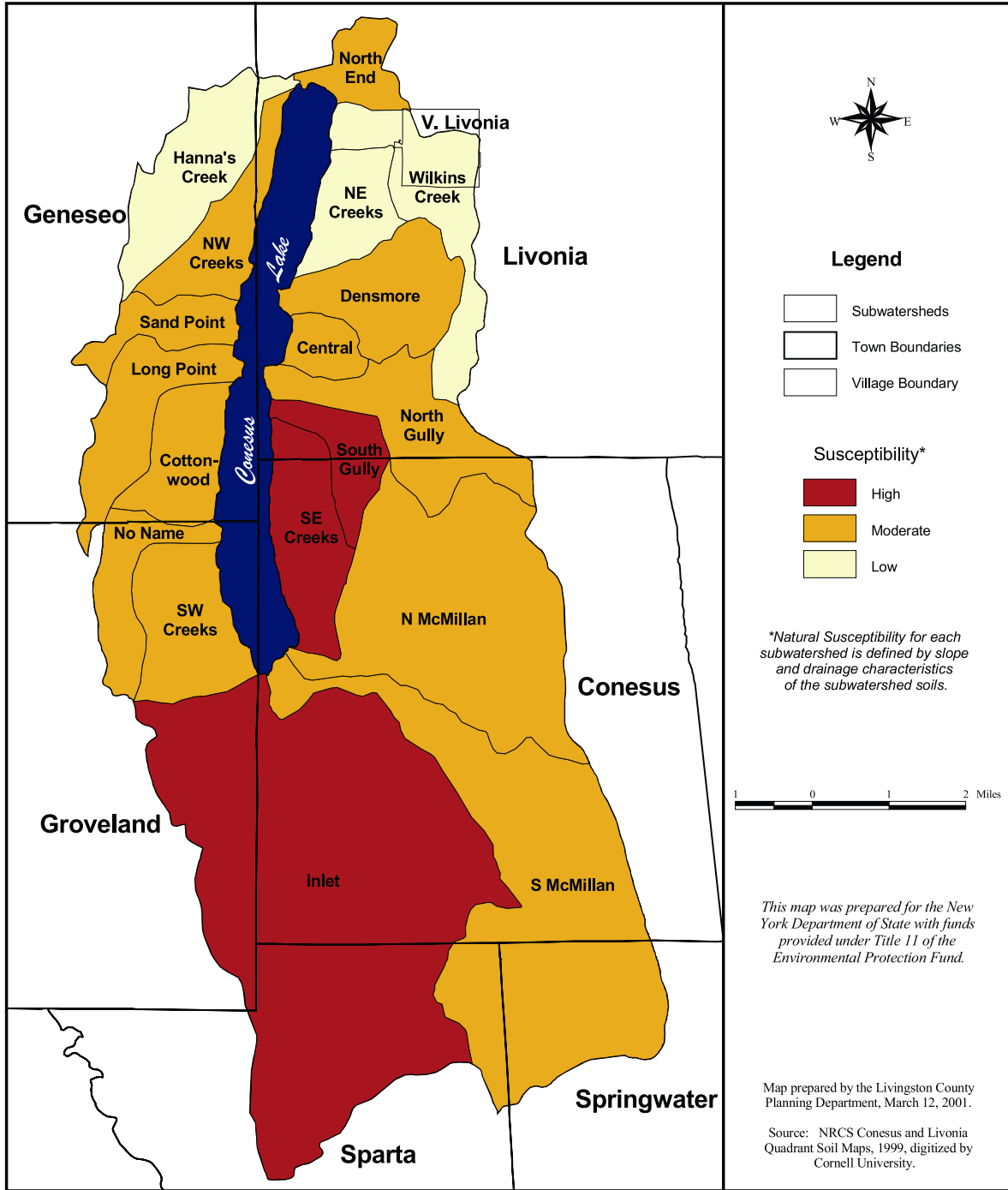
The Conesus Lake watershed is a mosaic of topographic features, soil types, and water courses. These natural characteristics combine to make certain areas more vulnerable than others to the effects of nonpoint source pollution, as illustrated in Map 3-1. Steep slopes along both the eastern and, especially, the western shorelines of the lake characterize the Conesus Lake watershed. The land to the south, except the Inlet region, is characterized by steep slopes as well.

Soils in much of the watershed are coarse and easily erodible. Other soils are shallow and exhibit different degrees of drainage limitations. These soil and topographic conditions give rise to situations where storm flow must move through short but steep gradients. The force of the water erodes the soil in the channel, making it deeper and steeper. Over time this process has created natural gullies along the eastern and western areas of the watershed. Human activities can accelerate the rate of erosion of these gullies by alterations in land use that disturb vegetation or increase runoff. Examples of these activities include paving and tilling that result in the transport of sediment and associated pollutants.



Sources: 1972 (Mills, 1975); 1985, 1988-1 and 1991-1993 (Crego, 1994); 1986-1988-2, 1989 & 1990 and 1995-1999 (NYSDEC); 2000 Makarewicz et al.

**Map 3-1
Conesus Lake Subwatersheds Natural Susceptibility
to Nonpoint Source Pollution**



3.1.5 RELATIONSHIP BETWEEN LAND USE TRENDS AND WATER QUALITY

The shoreline of Conesus Lake is densely developed, except for the area around the Inlet where the NYSDEC maintains a Fish and Wildlife Management Area. The area immediately surrounding the lake has a high percentage of impervious surfaces as a direct result of the preponderance of residential properties. Impervious surfaces do not allow water to infiltrate, thus forcing storm runoff to run directly over land into the lake, picking up pollutants along the way and increasing its erosive forces. The trend around the lake has been towards bigger homes with ever-increasing amounts of impervious surfaces, such as roofs and driveways.

Residential development is on the rise in more remote areas of the watershed. Development on steeper slopes is increasingly vulnerable to soil loss during construction and faces continued challenges for effective stormwater management. The surface area of roadways in the watershed has increased over time, leading to a steady increase in the concentration of sodium and chloride in lake water as a result of winter deicing practices.

Agriculture is a dominant land use in the Conesus Lake watershed and helps create the open vistas that provide much of the region's scenic beauty. Agricultural land uses have intensified in recent decades in response to national and regional economic forces. The trend in Livingston County agriculture is towards larger herd sizes and increased mechanization. Fields are cultivated closer to streams and drainage ways, and many hedgerows have disappeared. On the positive side, agricultural producers apply far less chemical pesticides than they did decades ago. Pesticide application is increasingly regulated, and there is a far greater focus on alternative methods such as integrated pest management.

3.2 Current Water Quality Conditions

Conesus Lake is a threatened water body. Water quality conditions in recent years have been characterized by an abundance of aquatic plants and algae, sporadic occurrences of bacteria indicating the potential presence of pathogens (disease causing microorganisms), increasing concentrations of salts, and detectable concentrations of pesticides. Changes in the food web in recent decades have contributed to a loss of water clarity. These conditions are of grave concern to the watershed community and have galvanized support for this comprehensive watershed management planning effort.

A network of streams makes its way to Conesus Lake. These streams drain subwatersheds, which are natural drainage divides in the landscape. The quality of water flowing into Conesus Lake from the stream network ultimately determines the quality of the lake itself. Both natural conditions and human activities in the subwatersheds affect water quality of the streams. Streams draining construction or agricultural areas, for example, have higher concentrations of sediment and nutrients. This central issue, that environmental conditions coupled with human activities in the watershed ultimately determine the lake water quality, forms the basis for the recommended actions that comprise the Watershed Management Plan. For this reason, the emphasis is on inputs to the lake rather than outputs. The quality of the water coming out of Conesus Lake is important for downstream uses and for developing nutrient budgets. However, the focus of the Watershed Management Plan is to improve the quality of lake water itself.

Because the largest tributaries to Conesus Lake (the Inlet and North and South McMillan creeks) enter into the south end of the lake, controlling inputs on the south end will have the greatest effect on water quality of the lake as a whole. However, the north end of the lake is affected by localized inputs from smaller streams and rivulets that can contribute high concentrations of pollutants during rainstorms and snowmelt. Many of the recommendations in this Watershed Management Plan are targeted at erosion and sedimentation, and are expected to have noticeable effects in the north end.

3.3 Use Impairment

New York State Department of Environmental Conservation (NYSDEC) is responsible for managing the State's surface water resources. Lakes and streams are classified according to their designated best use (for example, water supply, swimming, fish propagation, aesthetic enjoyment, and fish survival). Conesus Lake is classified by

NYSDEC as a Class A waterbody, with a designated best use for public water supply (after filtration).

There is an extensive program of monitoring and reporting to assess the extent to which the designated uses are met. Water bodies that may not consistently meet their designated best use, or for which changes in land use may threaten water quality, are placed on a Priority Waterbodies List (PWL) that is updated every two years.

A subset of the PWL list is the 303(d) list, named for the section of the federal Clean Water Act that requires states to report to EPA those waterbodies requiring a watershed approach to water quality protection or restoration. A watershed approach examines all point and nonpoint sources of nutrients and other contaminants and develops an integrated strategy for improvements. EPA recently expanded the scope of the 303(d) list to include waters affected by nonpoint source pollution as well as point source pollution.

In 2002, Conesus Lake was included on New York State's 303(d) list, which is a compilation of lakes, streams, and coastal areas where water quality conditions are not adequate to support a designated use. Water quality conditions are compared with criteria and standards defined in terms of the specific uses. The 303(d) list is a product of this assessment; water bodies are placed on the list when additional controls are needed to bring water quality into compliance with standards and criteria defined for designated uses.

Conesus Lake is listed as a "category 3" water body on the 303(d) list, meaning that additional data collection and analysis might be needed. The lists are revised every two years. Water bodies in need of more information are either de-listed (if conditions improve or an effective watershed management plan is implemented) or moved into a higher category requiring the development of a Total Maximum Daily Load (TMDL) allocation. A TMDL identifies all point and nonpoint sources of pollution into a given body of water and assigns maximum loads of pollutants to each source. The TMDL allocation is developed as a coordinated strategy to reduce pollutants in the receiving water.

Placement of Conesus Lake on the 2002 303(d) list highlights the importance of implementing effective strategies (both within the watershed and within the lake) to reduce nutrient and sediment loading and improve water quality conditions. The recommended actions presented in this document were developed through a collaborative process that fostered participation from the many stakeholders in the Conesus Lake watershed. In contrast, in the absence of implementation of an effective watershed management strategy, NYSDEC is required to develop total maximum daily loads (TMDLs) for pollutants in Conesus Lake, with oversight from the U.S. Environmental Protection Agency. This would constitute a mandatory program as opposed to a collaborative program, such as the one presented here. Implementation of the Watershed Management Plan recommendations is therefore essential for retaining local control over the future of the lake and watershed. However, there are no guarantees that voluntary actions will forestall or prevent TMDL development. The real determinant will be whether water quality conditions improve sufficiently to meet best usage.

3.4 Significant Issues Identified in the State of Conesus Lake: Watershed Characterization Report

This section summarizes the issues affecting the water quality and ecosystem of Conesus Lake. These issues include some symptoms of eutrophication (e.g., weeds and algae) and some causes (e.g., nutrients and sediments). The order in which the issues are presented reflects a combination of priorities assigned by scientific understanding and public sentiment. Additional detail may be found in the Characterization Report.

3.4.1 AQUATIC PLANTS AND ALGAE

Excessive growth of aquatic plants and algae creates problems for shoreline residents and recreational users of Conesus Lake. Aquatic plants interfere with access to the lake and become even more problematic as they die, accumulate on shore, and decay. Masses of decaying algae and aquatic plants give rise to unpleasant odors and create favorable habitat for bacteria and insects. As noted in section 3.1.2 (trophic status), excessive plant and algal growth are also of concern for the potential creation of THMs when water supplies containing high levels of organic matter are disinfected with chlorine.

3.4.2 NUTRIENTS

Nutrients such as phosphorus and nitrogen are naturally present in the environment. However, certain human activities (such as the use of fertilizers and failing septic tanks) can increase the background concentrations of these nutrients. Algal growth in Conesus Lake is limited by the availability of phosphorus. When human activities increase the level of available phosphorus, aquatic plants and algae may proliferate to nuisance levels. Controlling the amount of nutrients entering Conesus Lake is the most basic step in achieving long term control of aquatic plants and algae.

3.4.3 SEDIMENT

Sedimentation is a significant nonpoint source of pollution to Conesus Lake. Sediment loads in excess of natural levels are caused when the land in the watershed is disturbed without taking appropriate erosion control measures. Water resources management agencies, such as the EPA, NRCS, and NYSDEC, consider sediment to be the most significant nonpoint source of pollution throughout New York and the Nation.

A dominant visual feature of Conesus Lake is the sediment plumes at the mouths of tributaries after rainstorms and during spring snowmelt. This sediment directly affects the clarity of Conesus Lake and its aesthetic appeal for recreational uses. There are indirect effects as well; sediment deposition near tributary mouths will expand the habitat for aquatic plants by increasing the shallow littoral zone.

Excessive sediment concentrations in the water column can be harmful to aquatic life and will exacerbate the toxic effects of other pollutants by acting as an additional source of stress. Suspended sediment in the water column can increase temperature. Sediment deposits degrade habitat for macroinvertebrates and fish.

In addition to these effects on water clarity and habitat for the aquatic biota, sediment carries other types of contaminants into the aquatic system. This is an important aspect of watershed management, as many of the contaminants of greatest concern such as phosphorus and pesticides are carried into the streams and lake in association with sediment particles.

3.4.4 NON-NATIVE SPECIES

Non-native (exotic) species of plants and animals have caused problems in Conesus Lake that have no easy solutions. The alewife (*Alosa pseudoharengus*), a small non-native fish, has altered the food web and water clarity of Conesus Lake by its voracious predation of larger zooplankton. Larger zooplankton are more effective in grazing algal cells in the water column. Prior to the proliferation of the alewife, Conesus Lake had exceptionally clear water, thanks to the community of large zooplankton keeping algae in check (Forest et al. 1978). The clarity of Conesus Lake began to decline with the invasion of the alewife until a new invader, the zebra mussel, took hold. Zebra mussels (*Dreissena polymorpha*) are invasive freshwater mollusks native to the Caspian and Black Sea regions of Eurasia. They act as living filters increasing the clarity of the water and thus allowing light to penetrate deeper into the lake, which in turn allows aquatic plants to colonize new areas. Another invasive non-native species, Eurasian watermilfoil (*Myriophyllum spicatum*) has taken full advantage of this situation. This is a rapidly growing aquatic plant that tends to create floating mats that interfere with recreation. It spreads rapidly and is very difficult to control because it can root from small pieces that might be left behind during clean-up efforts.

Other exotic species such as the spiny waterflea (*Bythotrephes cederstroemi*), a tiny crustacean, the ruffe (*Gymnocephalus cernuus*), a fish, and water chestnut (*Trapa natans*), an aquatic plant, have been introduced to the Great Lakes. Ultimately, these non-native species can make their way into inland waters in the Finger Lakes region through interconnected waterways, bait introductions, and boat travel.

3.4.5 PESTICIDES

Pesticide concentrations in Conesus Lake have been monitored using analytical methods that achieve a low limit of detection. Measurable concentrations of herbicides and their breakdown products (metabolites) have been detected in the lake water (USGS & NYSDEC Pesticide Monitoring Program, 2000). No single concentration in Conesus Lake exceeds its associated water quality standard designed to protect human health and the environ-

ment. However, toxicological data on the effects of pesticide metabolites and mixtures of chemicals are limited. The chemicals detected in Conesus Lake at highest concentrations are herbicides used to control weeds in corn and soybean production. Some of these chemicals can persist for decades in lake sediments and may not reflect current inputs into the lake. Residential land uses may also be a source of pesticides in the lake water.

3.4.6 PATHOGENS

Indicators of the potential presence of disease-causing microorganisms (pathogens) have been found in tributary streams and, to a much lesser extent, in the nearshore areas of Conesus Lake. Data from the Livingston County Department of Health's Watershed Inspection Program indicate that some streams within the watershed exhibit elevated concentrations of two classes of indicator bacteria: total coliform bacteria and *E. coli*. The abundance of indicator organisms in a sample can serve as a warning of the likely presence of other, more dangerous, microorganisms.

Coliform bacteria are normally found in the intestinal tract of warm-blooded animals. Although the specific sources have not been identified, potential sources include waterfowl and wildlife, manure, and septic effluent.

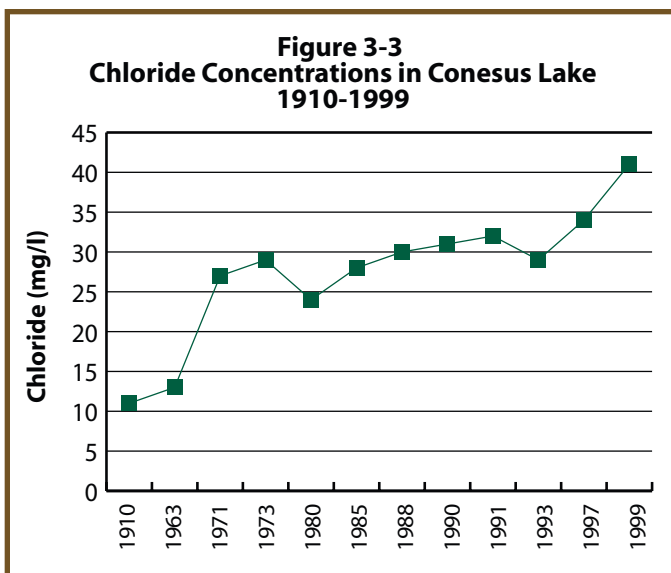
3.4.7 SALTS

Comparison of historical and recent data confirms that concentrations of sodium and chloride have increased over time. Sodium concentrations in Conesus Lake waters currently average close to 20 mg/l. According to the New York State Sanitary Code Part 5, Subpart 5-1 "Public Water Systems", sodium does not have a designated Maximum Contaminant Level (MCL). However, water supplies have health-related advisories for consumers. Water containing sodium at concentrations above 20 mg/l should not be used as a source of drinking supply for people on severely restricted sodium diets. Water containing more than 270 mg/l of sodium should not be used for drinking by people on moderately restricted sodium diets. Chloride concentrations have increased from about 10 mg/l in 1910 to over 40 mg/l in 1999 (Figure 3-3). Presumptive sources of sodium and chloride in Conesus Lake include salt dispersed along roadways.

3.5 *The Dual Approach to Protection and Restoration: Watershed and In-Lake Measures*

The core of the Conesus Lake Watershed Management Plan is a series of specific actions within the watershed and lake designed to bring about improvements to the quality of Conesus Lake. Ultimately, the quality of the lake is affected by the quality of water entering through the tributary streams. Environmental conditions and human activities in the subwatersheds affect the quality of the streams and thus the lake. Permanent reductions in the inflow of sediments, nutrients, pesticides, salts, and pathogens are needed. Protection from additional introductions of exotic species is needed. These imperatives are reflected in a series of watershed measures designed to reduce pollutant loading.

These watershed measures are complemented by in-lake measures designed to improve existing water quality conditions. The in-lake measures will help mitigate some of the symptoms of eutrophication, such as prolific weed growth. Some of the recommended in-lake measures are designed to alter the food web or internal phosphorus loading.



Sources: 1910 (Birge and Juday, 1914), 1963 (Berg, 1996, reported in Forest et al., 1978), 1971 (Godfrey, reported in Forest et al., 1978), 1973 (Mills, 1975), 1980 (Stewart, personal communication), 1985 (Stewart, personal communication, and Makarewicz and students), 1988 (Makarewicz and students), 1990 (Stewart, personal communication), 1991 and 1993 (Makarewicz and students), 1997 (Callinan, 2001), 1999 (Village of Geneseo Public Water Supply).