KINDERHOOK LAKE MANAGEMENT PLAN
September 15, 2012

INTRODUCTION:

This Plan was developed to satisfy a NYDEC request in 1997 and has been updated every two to three years since then. Its purpose is to provide an overview of the past and present conditions of Kinderhook Lake and a plan for the future. Presently, the lake serves the residents of approximately 280 riparian homes and many others in the community who enjoy the aquatic recreational activities of fishing, swimming, boating, jet skiing, water skiing, sailing, snow-mobiling and ice skating.

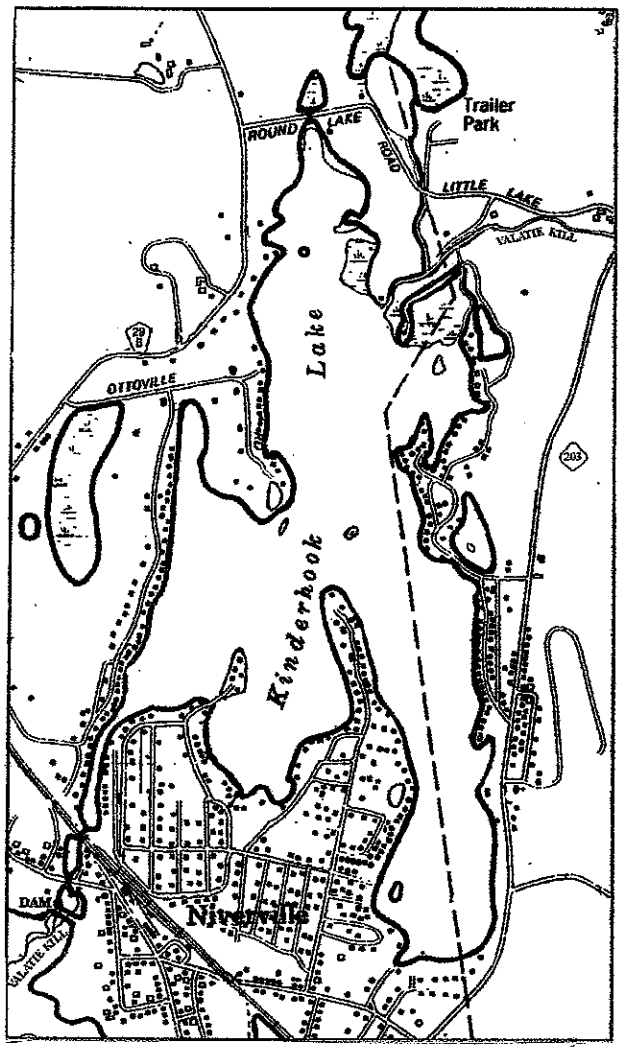
Kinderhook Lake has two lake organizations. The **Improvement Association (KLIA)** was established in 1933 to provide for the welfare of the Lake, to bring residents together in social events and to sponsor fund-raising events for worthwhile causes. The Association owns a Community Meeting Hall for activities and meetings. The **Corporation (KLC)** was established in 1953 as a share company to purchase the bottom of the Lake, the Nivers Dam and adjacent property from the Valatie Mills Corporation in order to improve the dam and control the water level. The Corporation, which has twelve Directors elected for three-year terms, is a volunteer, non-profit organization with about 400 members. It has no paid employees and is supported by annual dues and fund-raising activities. Its incorporated purpose is to "Maintain and Improve the Lake." Specifically, it is responsible for maintaining and repairing the dam, controlling the water level in the lake, monitoring and controlling aquatic plants and algae and keeping KLC members, as well as other local residents, informed by Newsletters and a web site, www. kinderhooklakecorp.org, regarding the condition of the lake, the dam and Corporation activities.

When **New York State Department of Conservation (NYDEC)** gained authority over New York State lakes, KLC assumed responsibility for interacting with that Department with respect to dam maintenance, water level and aquatic plant control and fish stocking. Since the lake is classified as a wetland by NYDEC, permits are required for construction or modifications of structures within 100 ft. of shorelines. In 1996, KLC became a member of the **New York Citizens Statewide Lake Assessment Program (CSLAP)** involved in the sampling of lake water and plants. The program permitted an assessment by NYDEC of the condition of the water in Kinderhook Lake relative to other lakes in New York State. As a result of that interaction, the Directors of the Corporation initiated a **Alum Program** in 2001 to treat the lake with alum (aluminum sulfate) to reduce the release of phosphorus from bottom sediments in the deep regions of the lake in the summer and provide better control of blue-green algae growth. Since that program produced major changes in the lake, this issue contains a detailed annual report; future issues will contain only a brief summary.

In order to provide KLC and NYDEC with an overview of the condition of the Lake and future plans, the Plan has been updated many times. The previous Plan was submitted in September 2010. Kinderhook Lake is a beautiful, natural resource and it is important to have a record of the history for members of both the Association and the Corporation.

DESCRIPTION

Kinderhook Lake is a residential lake located in the towns of **Kinderhook** and **Chatham, Columbia County, New York.** As illustrated by the dashed line on the map, the east side of the lake is in Chatham while the west side is in Kinderhook. The Village of **Niverville** is at the south end with a number of its homes along the shoreline. The lake covers an area of 375 acres and is fed primarily by the **Valatie Kill Creek** near the north end. Water level in the lake is controlled by the **Nivers Dam** which is on a channel at the south-west end of the lake. The dam and launch site are owned and operated by the **Kinderhook Lake Corporation (KLC).** Members of KLC use the site to launch power-boats and park vehicles. In 1999, the Corporation signed an agreement with New York State DEC to permit public use of the site for carry-on boats with electric motors. The lake is now listed as a public fishing site.



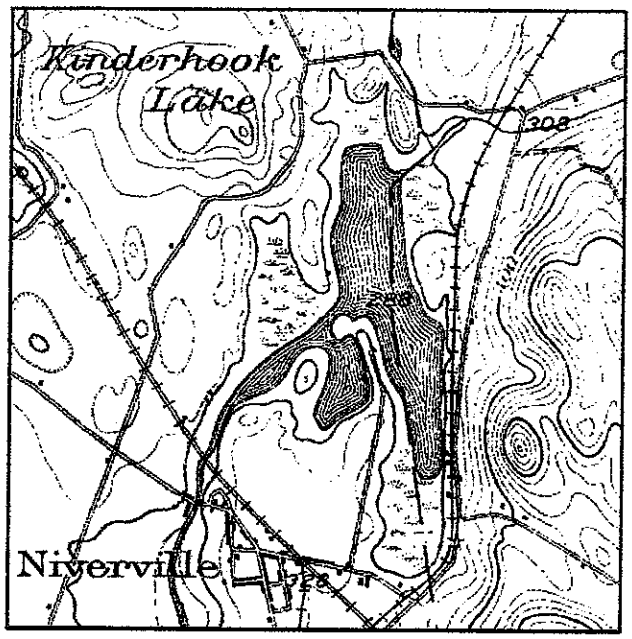
The lake was formed in the last glacial age and, as can be seen, has an extremely irregular shape with six islands, including one with a house. With a circumference of about seven miles, it has an interesting and varied shoreline divided into 292 parcels for homes. Only a few of these parcels are undeveloped. The lake has a muddy bottom but much of the shoreline is gravel so it provides a variety of habitat for fish and other aquatic life. The lake is fed by the Valatie Kill stream which empties a 41 square-mile watershed. Heavy rains and rapid spring runoff sometimes cause shoreline flooding. In order to minimize flood damage, the lake level is lowered about 4 feet each winter. This also tends to kill aquatic plants along shorelines and allows home owners to repair docks and water-fronts.

Based on a survey conducted in 2003, 44% of the homes are winterized but only 33% are used year-round. Over the past ten years, only a few new homes have been constructed on lake-front properties but a number of cottages have been enlarged for year-round occupancy. Half of the homes have been purchased since 1990; most of those since 1985. Only 17% of the households include children so most are occupied by older adults with families and friends who visit in the summer.

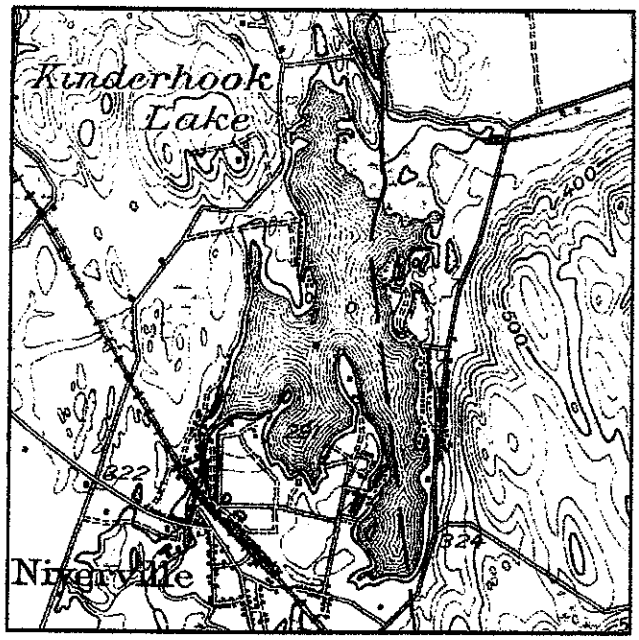
Swimming is the most popular activity (62%), followed by fishing (58%), power boating (52%), canoes and kayaks (39%), rowboats (38%), water skiing (29%) and ice-fishing (12%). Most own at least one canoe, rowboat or kayak, 37% own a speedboat, 12% a pontoon boat and 12% a personal water craft. Members indicate that they love the lake for its peace, quiet and beauty. Concerns were expressed in the survey regarding water quality, algae, weeds and jet-skiis.

Since there is no municipal sewer; homes have individual septic systems. Owners reported that 30% have upgraded systems, 5% are cleaned annually, 12% biannually and 43 % less frequently. Homeowners are requested to have septic tanks cleaned biannually. The town of Kinderhook recently listed a municipal sewer system as high priority in their "Comprehensive Town Plan" but it will be extremely expensive and most likely will not be installed for a number of years.

EARLY HISTORY



USG SURVEY 1900



USG SURVEY 1930

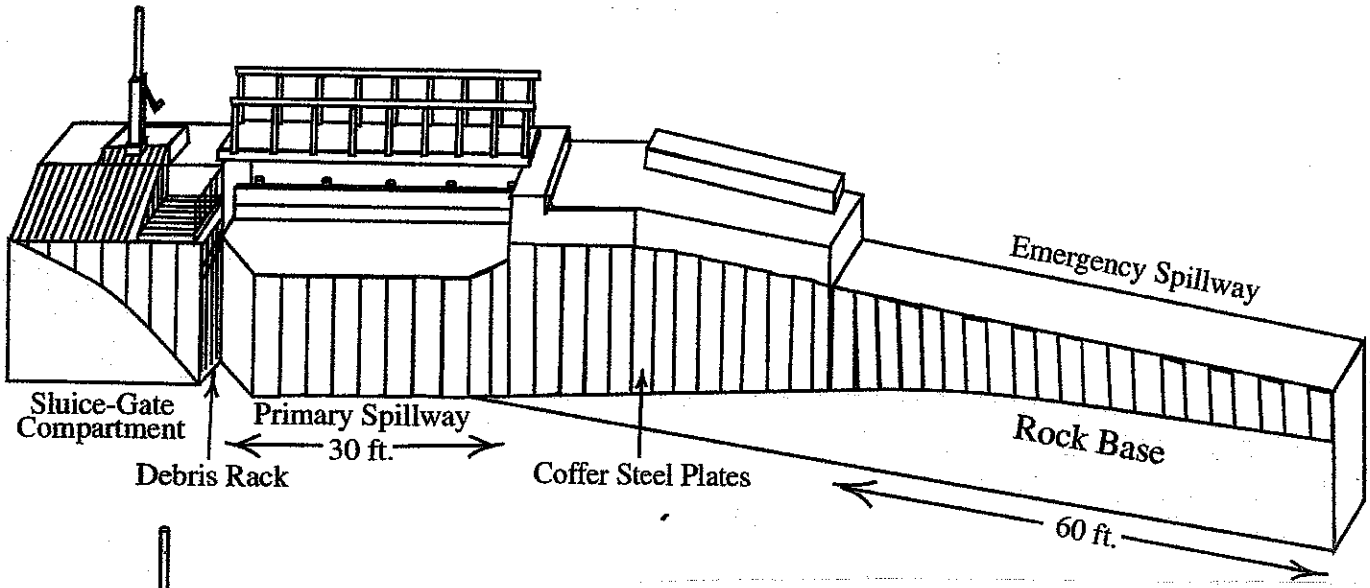
The **Mahican Indians** called the lake **"Wogasawoochuk"** but the lake they knew was quite different from the one we see today. The US Geological Survey Map above illustrates that the lake was much smaller in 1900, with most of the islands in the present lake connected to the shorelines as peninsulas. In fact, prior to 1710, when **Bill Nivers** and several farmers built a 4-ft. dam on the effluent stream of the lake, the small bay on the south side of the outlet stream was an isolated pond at low-water level and the swamp surrounding much of the lake was covered with water only at flood stage. The original stone and earthen dam was built to generate power for a saw mill and later for a grist mill. However, as can be seen on the map, much of the shoreline of the lake was inaccessible. Thus, the lake was quite different, even in the 1800's, than it is today.

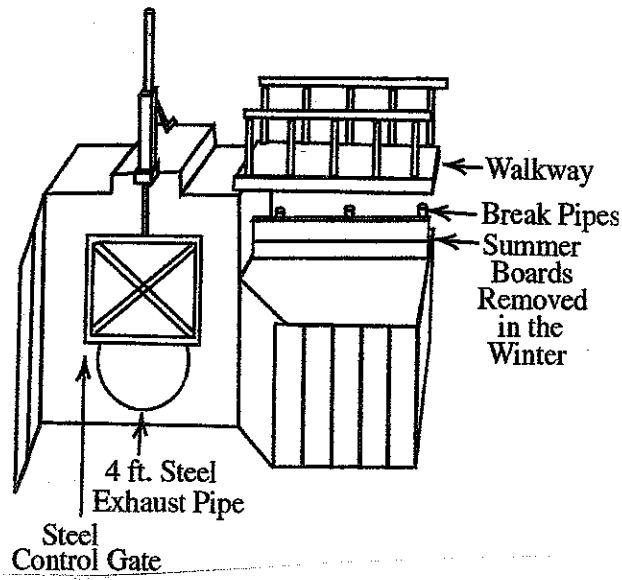
In 1841 the **Albany and West Stockbridge Railroad** ran its rails through the village and along the east shore of the lake, as shown in the 1900 map. It gave the farmers an outlet for wood and produce. Also on the map, note the road leading to the point of the peninsula that extends into the lake. The road was access to the **"Great Park"** on the point which was a gathering place on weekends for picnics and outings on the lake. Originally, the lake was called **"Big Fish Lake"** but, in 1853, it was renamed **"Kinderhook"** by President Martin Van Buren. He often had his boat launched into the lake from the east shore and felt it should have a more distinguished name. However, one of the greatest changes for the lake came in 1910 when the lake was raised another 2 ft. and **"Electric Park"** opened along the northeast shore. The **Albany Southern Railroad**, which then ran a third-rail electric trolley-line between Hudson and Albany, developed a park with electric lights and power-driven amusements, the first of its kind in the northeast. A hotel, dance hall and 5 boat-rentals filled the lake with visitors on week-ends in the summer. In fact, in 1909, a bridge was built from the east shore to **Hawley Point,** the peninsula in the middle of the lake. The bridge and boats permitted revelers to get from the Park, which was in Chatham and dry, to the hotel and dance hall in Kinderhook, where liquor was served. Unfortunately, the bridge, which was suspended on wooden pilings, went down in the winter of 1911. At the close of the first world war, the park was closed and shoreline property was subdivided and sold but some of the pilings which supported an amusement ride above the lagoon on the east side of the lake are still visible and the building that was **"Winslow's"** boat rental and restaurant are still there. As illustrated in the 1930 survey map, raising the level of the lake extended it almost to its present shorelines and permitted construction of more cottages.

THE NIVERS DAM

In the 1940's, the dam height was increased by another 2 ft. to increase the depth in low-lying areas and create more shoreline for property sales. However, the dam was owned and managed by the **Valatie Mills Corporation** which used the water to generate power - cottage owners were at the mercy of the company in terms of water level. On the other hand, the dam had not been reinforced well and, in 1949, it breached during a flood and drained the lake, almost to its original level - residents called it "a mud puddle." Valatie Mills repaired the dam but residents were at the mercy of the Mills in terms of the lake level. To solve the problem, the **Kinderhook Lake Corporation** was organized on the 26th day of January in 1953 to purchase the bottom of the lake, the dam and adjacent property. The purchase price was $18,000, with legal expenses of $1,250. Another $18,000 was raised from 201 property owners around the lake to rebuild the dam so that, in the summer of 1953, a letter from the Corporation indicated the level of water in the lake "never has fallen below the top of the dam" and "property values have increased from $350 to $1,000." In the early 70's the sluice gate on a 4-ft. drain pipe in the dam became nonfunctional, so that it was impossible to lower the level of the lake. In 1985, lakefront owners bought "Dam Shares" to install a new sluice gate and, in the winter of 1989/1990, a 60-foot emergency spillway was added to meet the the 100-year flood standard. In order to be prepared for future repairs, the Directors of KLC increased voluntary dues and developed a "Dam Reserve Fund."

The "Nivers"Dam





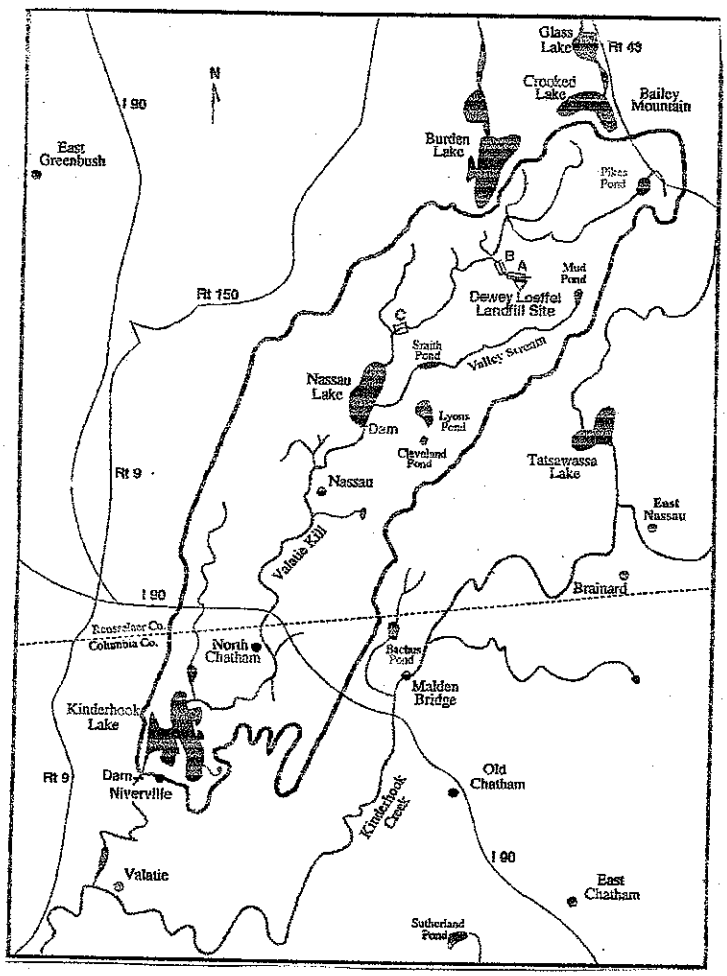
The drawings illustrate the present construction of the dam, with the primary and emergency spillways and the sluice-gate compartment where water enters to pass through a 4-ft. wide pipe with a control gate that is raised and lowered with a manual crank to control water flow. Water enters the sluice-gate compartment through the debris rack and out through the pipe. In the summer, 20-in. boards are positioned against pipes and the control gate is lowered to close the pipe and raise the water level in the lake. In the winter, the boards are removed and the water is lowered to a level of "no more than 33 in. below the primary splillway," based on a permit from NYDEC.

During the spring of 1999, the gate on the dam froze in the open position and barriers had to be placed over the 4-ft pipe to raise the level in the summer. When a coffer dam was built in front of the dam to inspect the gate, it was discovered that 3 foot of the face below water level had eroded away. Reinforcing rods were driven into the dam and bedrock, space between the coffer steel and the dam was filled with concrete, the spillway was modified and the gate was repaired. The face of the primary spillway was covered with coffer steel and designed in a way that permits a coffer section to be lowered into it to shut off water flow so the gate can be examined and repaired. Thanks to the foresight of KLC Directors and generosity of KLC Members, the expenditure of $67,603 was supported entirely by the KLC Dam Reserve Fund.

In 2006, KLC received notification that insurance on the dam was being cancelled. On checking with NYDEC through 'freedom of information,' the Directors of KLC found that the classification on the dam had been changed in 1971 from A "low risk" to B "intermediate risk" with no documentation and no notice to KLC. KLC formally objected to the change as violating State Regulations; in 2009, the classification was changed back to A. Although the dam was judged in good condition by an inspection in 2006, minor water leakage was noted through the central section. Concrete in the front face reduced the leakage but the section was old and needed to be upgraded. Based on the above information, KLC requested a Permit from NYDEC in 2008 to cover the front face of the central section with reinforced concrete and coffer steel. The Permit was not granted and had to be resubmitted in 2010 by a new engineer. The plan was approved by the NY Corp. of Engineers and NYDEC in 2011 and upgraded by Keller and Sons in the winter of 2011 at a cost of $117,000. Monies for the construction were obtained from the Dam Reserve Fund. The entire front face is now covered with coffer steel, so the dam should be sound for many years to come. Based on revised NYDEC Dam Regulations issued in 2009, Reports must be submitted annually.

THE WATERSHED

Kinderhook Lake receives its water from a watershed that extends from **Bailey Mountain** on the north to **Niverville** on the south, an area of about 41 square miles. At one time, much of the area between Kinderhook Lake and Nassau Lake was farmland while the area above Nassau Lake is much more hilly with lowland swamps. In the 50's and 60's, a landfill site north of Nassau Lake was used by GE and other chemical companies to dump solvents and toxic wastes, including PCB's. The site was closed in 1968, but chemicals leached into the Valatie Kill. down into Nassau Lake and some even passed into Kinderhook Lake. In 1984-85, DEC contained this **Dewey Loeffel** landfill site with a slurry wall and cap. In 2001, contaminated soil was removed from a site next to the landfill.



In 2003 and 2004, two remaining contaminated sites in the Valatie Kill flowing into Nassau Lake were dredged. Presently, the bottom of Nassau Lake has several sites of concern and there are restrictions on the consumption of fish. NYDEC has indicated that, since there are no more contaminated sites upstream and PCB movement into the lake has been stopped, that contamination levels in the lake-bottom should drop. However, it was recently announced that an improved containment and monitoring system may be constructed around the dump site.

Fortunately for Kinderhook Lake, the Nassau Lake dam has served as an effective barrier to the movement of chemicals. A new dam on Nassau Lake, which was completed in 2009 and paid for by GE, should insure that there will be no movement of contaminants into Kinderhook Lake and the Kinderhook Creek for many years to come. Today, the bottom of Kinderhook Lake is essentially free of contaminating chemicals. However, the Department of Health has a restriction on the consumption of the American Eel. It is a long-lived fatty fish which tends to store chemicals. In fact, NYDEC recently issued concerns about consumption of fish from any lake, stream or river which has restrictions on fish - not only because of possible PCB and herbicide contamination, but of mercury as well.

VALATIE KILL WATER QUALITY

Since the Kinderhook Lake watershed is large and much of it has been used for agriculture, nutrients have been flowing in for centuries. Thus, nutrient levels in lake water are high and aquatic plants and algae have been a persistent problem.

During the summer of 1982, KLC commissioned Dr. Aulenbach at RPI to perform a study of water flow and nutrient input from the Valatie Kill into Kinderhook Lake. That study indicated that at low water-flow in the summer, the stream puts about 2 million gallons into the lake per day, but, after a single rainfall, it can rise to about 80 million gallons. Under flooding conditions, as much as 150 millions can enter per day and raise the lake level by about 4 foot. The study found that nitrogen levels entering the lake were acceptable but that phosphorus levels were sufficient to support excess algae growth. To expand on that study, Directors of KLC took samples of lake water for analysis at various sites from 1993 to 1996 and, in that year, began participating in the **Citizen's Statewide Lake Assessment Program (CSLAP).**

Participation in the program was discontinued in 2001 but detailed data has been assembled and published in Summary Reports each year since that time. In 2004, a water sample taken from Nassau Lake was found to contain the same level of phosphorus (0.04 ppm) as water entering Kinderhook Lake from the Valatie Kill. However, phosphorus in the Nassau Lake water sample was bound to green algae and sediment while the sample of water from the stream entering Kinderhook Lake contained no algae or sediment - all of the phosphorus was present as free, ortho-phosphate. Thus, it appeared that, at low water flow, Nassau Lake's green algae and sediment were being oxidized as they pass down the Valatie Kill stream.

Based on that information, an alum-addition system was set up in 2006 in the Valatie Kill stream to bind phosphate before it enters the lake. However, the storage equipment for alum solution was not adequate and the equipment was washed out several times by flooding. Commercial firm installation of automated alum-addition equipment proved too expensive so the program was discontinued. In the same year, the **NY State Soil and Water Conservation Department** performed an analysis of surface water flowing into the lake from a number of shoreline sources. One major source of runoff is a cattle farm at the south end of the lake. A proposal was presented by the **Dept. of Agriculture** to limit the runoff but the plan was not implemented because, in 2007, the farm was claimed to have been sold to an individual who wanted to develop the property as a nature preserve. However, instead, it has been rented to an individual who is continuing to raise cattle. If cattle-farming is continued, KLC should consider having the State Highway Department install a storm-water containment system.

Although KLC has considered initiating a septic system test program, a number of reparian owners have indicated that they would not permit their systems to be tested. Periodic tests for coliform bacteria along suspected shorelines have not revealed any problems.

SUBMERSED WEEDS

Since nutrient levels in the water and most bottom sediments have been high, the following plants have presented persistent problems over the years: 1) Bushy Pondweed, 2) Curlyleaf Pondweed, 3) Eurasian Milfoil and 4) Water Chestnuts.

BUSHY PONDWEED: Bushy Pondweed is a native aquatic plant which grows in fertile bottom soil at 2 -to 4-ft. depths. It is an annual weed which spreads by seeding and, under the proper conditions of high water clarity and warm temperatures, can completely fill fertile shorelines. The seeds survive freezing, so the winter drawdown, which exposes the shallow shorelines to frost and ice, does not prevent its annual growth. Prior to the initiation of the alum program in 2001, this pondweed, as well as **Leafy Pond Weed** were not a major problem but increased water clarity in 2004 caused both of them to spread rapidly. Both of these aquatic plants often become a problem when annual drawdowns are performed. An application for a Permit to treat limited shoreline areas with Aquathol K was submitted to DEC in 2008 but not used because the Permit arrived too late in August to be useful. However, in 2005, the density of both weeds decreased and have not been a major problem since then.

CURLY-LEAF PONDWEED: For a number of years, curly-leaf pondweed was a major nuisance plant on the lake and still is the major weed in Nassau Lake. Again, it is not native to this area and is propagated by seed as well as budding. It grows under the ice in the winter and reaches the surface early in the spring. By mid June in the 60's and 70's, most of the 2- to 9-ft depths in the lake were filled with this plant at such a density that boats could not pass through. Residents made appointments for a cutter-boat to carve paths through the dense beds so residents could get into deeper regions of the lake.

However, once the gate on the dam was repaired in 1985 and winter drawdowns were initiated, coverage was reduced to 5- to 9-ft. depths. The plants died in July but dying stems collected in ugly, large, fermenting masses on the surface and deposited thick, brown sediment in the water as they decayed.

EURASIAN WATERMILFOIL: A resolution of the curlyleaf pondweed problem came in the form of Eurasian Watermilfoil which, concomitant with the drawdown, began spreading in the lake. By 1989, Eurasian milfoil, which also is not native, had displaced pondweed in the beds and very little pondweed was evident anywhere. By 1996 and '97, the milfoil beds were extremely dense and persisted throughout the summer. Cutting and harvesting were attempted but found to be impractical and spread the cuttings. Chemical treatment with **Sonar®** was considered but rejected because Kinderhook Lake water through-put is too high. An extensive investigation of **sterile grass carp** was conducted and a proposal to introduce the carp was presented to NYDEC in 1997. The proposal was rejected by NYDEC because of concerns that the fish might not be sterile and escape into the Kinderhook Creek and Hudson River.

However, the next year, 1998, milfoil beds at the north end of the lake began to disappear in July. In 1999, not only north end beds, but those in the center of the lake decreased dramatically in July. Since this behavior was typical of milfoil infestation by the **milfoil weevil** *(Euhrychiopsis lecontei)*, plants at the north end were inspected, weevils were found and identified by Cornell University as the weevil. Since 1999, a number of milfoil beds have disappeared completely and all are dramatically reduced in size. For the past ten years, density has been less than 1% of that in 1997. However, curlyleaf pondweed reappeared in the beds and **Coontail** and **Sago Pondweed** began growing at the shallow edges. Although very little milfoil has been visible on the surface of the lake in July and August, the beds were alive with growth below the surface. In 2009, high water clarity permitted them to reach the surface again. From 2010 to date, growth has been vigorous in June but has died back by July 1st and has remained low throughout the summer. Growth in the beds will continue to be monitored. Significant rooting of cut segments occur along shorelines in the summer but most of that is killed by the winter drawdown.

WATER CHESTNUT: Water chestnut is an insidious aquatic plant that is indigenous to the Far East. It is an annual which grows rapidly from nutlets in the spring in shallow, 2- to 5-ft. depth water. If left uncut, it can fill entire water-ways within a few years. In the early 90's, water chestnut plants had virtually filled the shallow bays at the north end of the lake and began moving into other regions. Cutting, pulling and harvesting in mid-summer was a continuous and laborious task. Based on the fact that the plant is an annual and produces nutlets in August, one of the KLC Directors modified the cutter-boat and began cutting the tops of the plants off as soon as they appeared in the Spring to prevent nutlet formation. Within a year, coverage was cut by about 40%; in two years by about 80%. By 2005, less than 1% of plants remained. However, pesistent engine problems on the cutter boat prevented effective cutting in 2008 and 2009 and, in July 2009, the cutter boat was washed over the dam by a flood and badly damaged.

Since the NYDEC Drawdown Permit, which had been issued for many years, indicated that mechanical cutting of aquatic weeds was not permitted, a meeting was arranged with NYDEC in 2010 to present the results of early cutting and request that we be permitted to use the cutter boat. As a result of that meeting, KLC received permission to cut water chestnuts mechanically in June and July, the boat repair was repaired and a new engine was purchased. Since most of the chestnut growth at the north end was in shallow water next to cattails, a three-foot depth line was established for cutting in 2011. This has forced viable nutlets to be dropped into the shallow shoreline area and, in two years, has eliminated almost all growth in the deeper bay area. Manual clipping of leaflets has essentially eliminated them from the rest of the lake.

ALGAE AND ZOOPLANKTON

For a number of years, water samples were examined microscopically in the spring to detect the emergence of **blue-green algae** and trigger the initiation of copper sulfate treatments. Beginning in 1998, the method was employed throughout the summer to monitor the level of blue-green algae and, in 2001, to monitor **diatoms**, various forms of **green algae** and a dinoflagellate called **ceratium**. Since preparation of the water samples for microscopic examination involved filtration and drying, green algae were difficult to count and zooplankton, such as daphnia and cyclops, disintegrated and were not visible. Thus, an alternative, wet method, was developed to examine a concentrated water sample and semiquantitavely monitor various forms of green algae and zooplankton. Both of these methods have been used since 2001 to follow the effect of alum and copper sulfate treatments.

BLUE-GREEN ALGAE: Since nutrients in lake water are high, and have been for many years, mid-summer bloom of blue-green algae has been a persistent problem. For more than thirty years, copper sulfate was applied to the surface every two weeks from July 1st till mid August. When NYDEC assumed authority over herbicides, KLC began requesting annual Permits for continued copper sulfate use. Since it is a toxic substance, signs had to be posted restricting use of the lake and water from it for 24 hours following treatments. In spite of continued use, copper sulfate treatments were problematic - blue-green algae levels were depressed by the treatments but thick gray scum was left on the surface and blue-green scum increased rapidly after each treatment. In 1998, the State CSLAP Report indicated that phosphorus levels in the lake had become so high in the summer that the lake was at risk of having a fish kill. In fact, in 1999, levels became so high that several copper sulfate treatments did not depress bg levels at all.

Based on a NYDEC recommendation, KLC explored the possibility of installing aerator units in the deep regions of the lake to increase oxygen levels and reduce phosphorus release from bottom sediments. Since phosphorus levels in those deep regions in the summer were as much as thirty times those on the surface, it was decided that aeration might simply drive phosphorus to the surface. Thus, it was decided that alum (aluminum sulfate) treatments, rather than aeration, should be attempted. Aluminum ions in alum permanently bind phosphate ions, preventing them from coming to the surface and feeding plant and algae growth.

Since studies indicated that phosphate was coming, not only from the bottom, but from the Valatie Kill and shorelines, commercial firms, like Allied Biological, indicated that they would not be involved because they could not guarantee the results. Thus, KLC presented a proposal to Region 4 NYDEC in November 2000 to treat the lake with alum and a 5-year study Permit was granted in January, 2001. A $5,000 grant from Hudson River Bank was received in 2002 to support the program and a $1,000 grant from Niagra Mohawk in 2003.

Since alum is acidic, simultaneous addition of base is often required in lakes to insure that additions are not toxic to fish. Initial testing revealed that surface water was quite pH-tolerant, so a total of 25,000# of alum was carefully added to the surface, in 1,000# units, in 2001 with pH testing before, during and after additions. Although water clarity was not controlled as well as had been hoped, the acidity of alum was neutralized rapidly and no fish toxicity problems were encountered. To insure that the Water Quality Program was moving in a desirable direction, the Directors of KLC hired a marine biologist, Mr. Steve LaMere, in 2001 to perform a detailed analysis of the lake, review the alum program and make recommendations regarding weed and algae control. Mr. LaMere had previously served as a consultant to the Federation of Lake Associations (FOLA) and had broad experience in analyzing and improving the water quality of lakes. Based on his analysis, treatment of the deep regions of the lake with alum was the correct direction to pursue but that input from the Valatie Kill, surface runoff following rains and septic systems must be reduced to provide effective algae and weed control. He recommended that septic system testing be performed to identify leaking systems and that the population of panfish, particularly white perch, should be reduced to increase the population of zooplankton which eat algae.

One of the disturbing conclusions of Mr. LaMere's study was that the lake water, which is alkaline, contains sufficient calcium to support zebra muscles. Although inspections and cleaning of power boats at the KLC launch site might avert contamination, the procedure would be expensive and there are a number of other sites on the lake where contaminated boats might be launched. Signs were posted at the KLC launch site regarding cleaning and, thus far, there is no indication of contamination.

Since the lake appeared to tolerate alum additions extremely well, a total of 24,400# was added to the surface and 20,000# to the three deep regions of the lake in 2002. Additions to the deep regions suppressed phosphorus release but did not lower the levels enough to prevent algae blooms. In 2003, 43,050# was added to the deep regions and 12,000# to the surface. For the first time, probably in history, the level in the the deep regions was kept low all summer, total phosphorus in the lake was reduced by about 95% and blue-green algae levels did not rise until August. Water clarity remained at 4 ft. until the second week of August and there were no serious blue-green algae blooms. However, in contrast to 2003 when there was little rainfall, in July 2004 it rained almost every day.

Since the Valatie Kill stream, septic systems, lawn and garden fertilizers and farm runoff all contribute nutrients to the lake, blue-green algae levels began to rise in July and continued to rise until, in mid-August, they reached levels which began to produce unsightly surface scum. In spite of the fact that deep phosphorus levels were low, it was clear that, alum alone, could not provide adequate control. Thus, copper sulfate, in solution had to be added to the surface of the lake. However, in contrast to previous years, when copper sulfate was used alone, this treatment was followed the next day by a treatment with 1,500# of alum to bind released phosphorus from the dying algae and prevent a rebound rise in blue-green algae. The approach worked as anticipated - blue-green algae levels were reduced by 90%, water clarity increased 1 ft. and beneficial forms of algae increased to take the place of the blue-green. Water clarity remained high for the rest of the Summer and Fall.

Athough phosphorus levels in the deep regions of the main lake remained low, bottom sediments in the inlet and a small south bay continued to release phosphorus and feed algae blooms. Thus, alum additions to the deep regons of the inlet and the bay were increased from 10,500# in 2005 to 20,500# in 2007 while surface additions were reduced from 9,000# to 1,500#. However, NYDEC became increasingly concerned about the addition of alum to the lake and, in the Spring 2008, requested a meeting to review the drawdown and chemical treatments. Following the meeting, they indicated that alum could no longer be used. The reason given was that the EPA list of approved herbicides does not include alum. Since NYDEC follows that list, it will no longer approve its use. Thus, alum was not used in 2008.

However the ruling did not make sense and a letter of protest was sent to the Commissioner of NYDEC. It indicated that the decision was ridiculous - toxic substances are permitted but non-toxic are not. The letter indicated that EPA lists Alum as an "inert ingredient" which can be used in conjunction with controlled hebicides and, thus, should be permitted. Since NYDEC's concern seemed to be that alum was being used to control aquatic plant growth, an application for a Permit to use alum in 2009 to reduce phosphorus pollution was submitted with no mention of algae or aquatic plants. A Permit was received and 6,000# of alum was added to two deep regions in 2009. Water clarity remained at 4-ft. or greater all summer and there were no serious blooms. However, a new form of filamentous algae appeared with the same morphology as blue-green algae but about 1/10th the size - it clouded the water but did not form a scum on the surface like the normal blue-green forms.

In 2010, 4,000# of alum was added to the deep region of the south-east bay but phosphorus levels were still higher than desired. Since surface water in the lake warmed to 80 degrees early in June and blue-green algae began forming about two weeks earlier than normal, the first copper sulfate treatment was on June 15th. Five more treatments provided control through Labor Day. As in 2009, the fine filamentous algae formed early and clouded the water but was followed by a bloom of spherical Gomphosphaeria wichurae, which also clouded the water. Rapid growth of Anabaena did not occur until mid August and very little Lingbya was present.

In order to provide a guideline for copper sulfate treatments, a microscopic count of 100 for the lingbya-form of blue green algae was establish as the trigger for the application of 1,000# of copper sulfate. In 2011, five applications kept the surface of the lake essentially free of floating blue-green scum. In 2012, five treatments were applied but two treatments were delayed because levels were below 100. In spite of extremely hot dry weather, with water temperatures at 85 degrees for several days, levels of phosphorus at the 20-ft. depth in the three deep regions were 0.04 ppm on July 25th, the same as they were on the surface prior to alum applications. Furthermore, water clarity, which normally decreases in early September, increased to 9 ft in the center of the main lake and 15 ft. at the inlet on Sept. 5th. In 30 years of observation, this is the first time clarity has increased in September and, rarely has it ever been more than 8 ft.

OTHER FORMS OF ALGAE

As a result of detailed microscopic analysis of water samples over the past five years, we now have more information on the various forms of algae and zooplankton. In early Spring, when the water temperature is below 70 degrees F, **Diatoms,** which are food for fish fry, predominate. As the water warms, **ceratium** and various forms of **green algae** begin to emerge, followed by **blue-green algae.** Since ceratium is yellow-brown in color and green algae is bright green, the lake changes color as the various forms emerge and bloom. Since microscopic studies revealed that the three major forms of blue-green algae, **Anabaena, Lingbya** and **Gamphosphaeria,** have a gelatinous coat which binds aluminum and copper ions more readily than the other forms of algae, it seemed possible that treatments of copper sulfate, followed by alum, might shift algae populations from blue-green to the other forms and reduce regrowth. Thus, as indicated above, combined treatments in 2004 through 2007 appear to be more effective than either alone. However, NYDEC's restrictions on the use of alum in 2008 prevented further studies. Copper sulfate treatments in 2009 and 2010 were limited to 1,000# rather than maximum permitted by NYDEC in order to reduce Lingbya in favor of the other forms. Analysis of Nassau Lake water in August 2005, indicated that the major algae is not blue-green but green and that the sample contained copious amounts of brown sediment, probably from rotting pondweeds. A proposal was submitted to NYDEC in 2005 to install an aeration unit in the south bay but there was no response from DEC on the request. In 2008, The KLC Board decided io continue copper sulfate treatments and not to pursue aeration.

FLOATING BOGS

For as many summers as anyone can remember, floating bog islands have come up in August on the south west side of the lake near the outlet channel. The bogs, which are about 5 ft. wide and 10 to 20 ft. long, appear to have been formed when dying weed stems wrapped around small tree and bush roots which were left on the edge of the stream when the water level was raised the first time in the 1700's. Each summer internal fermentation creates sufficient gas within these weed-masses to bring them to the surface. When they are at the surface, they can be seen and avoided by boaters but, often, they hover one or two feet below the surface and present a major threat to high-speed boats.

For a number of years, residents attempted to move the bogs but they were too large and massive and were fastened too firmly to the bottom. Seven years ago, several KLC members began tearing the bogs apart with hoes and saws. When they reached the center of each one, they found the old cut stumps and roots of trees, often 2- to 4-inches in diameter with sawmarks on the stumps. As the bogs were reduced in size and cut into smaller units, portions floated free. Some were dislodged by wind action and floated to shorelines or down the canal to the dam. Others were torn completely apart and the parts allowed to settle to the bottom. Cutting is performed whenever they appear and tall flags are posted on them so they can be seen even when submerged.

FISH POPULATIONS:

Indian and early settler's named Kinderhook Lake "Big Fish Lake." The big fish, we understand, were largemouth bass and walleyes. The lake still contains largemouth bass but the walleyes have been removed by overfishing.

In the 40's and 50's, walleyes, bass, crappies and catfish were stocked in the lake by KLIA. In 1998, a NYS record **black crappie**, 3 lb. 9 oz., was taken from the lake. In 1995, a fish survey by NYDEC stated that the state record **largemouth bass** may be in the lake and a 10-lb., 26 in. largemouth was caught and released in 1997. However, the survey found that the lake was dominated by white perch and they recommend that predator fish be added. Accordingly, $1,811 was collected in donations from KLC members in 1996 and 40 14-16 in. northern pike, 40 12-14 in. walleyes and 1,100 smaller walleyes were purchased and added to the lake. In spite of the fact that both large walleyes and northern pike were caught by fishermen and they undoubtedly consumed white perch, a 2001 survey by NYDEC indicated that the lake still had so many **white perch** that even more predator fish should be added. The survey also indicated that the largemouth bass population was declining.

Two factors were considered to have contributed to the largemouth decline: 1) the annual drawdown, which was begun in 1985, dramatically decreased weeds along shorelines and 2) the increase in the population of white perch. They swim in huge schools along shore-lines in the spring and consume fish eggs and fry.

Accordingly, **tiger muskellunge** were stocked by NYDEC in 2006, 2008, 2011 and 2012 and largmouth bass were stocked in the lake in 2002, 2004, 2006, 2008, 2009, 2010 and 2012 by KLC. Based on a concern that the populations of bass and blue gills were still dropping, NYDEC peformed gill-net and shocking studies in 2009 and 2010. Their conclusion was that about 90% of the fish in the lake are white perch - unless that dominance is decreased, all other fish species will suffer. The only species which appeared to be surviving and increasing in numbers were **small-mouth bass.** They breed on the rocky shorelines created by the drawdown and the fry go deep and hide in the rocks rather than on shorelines.

In 2010, a white perch derby removed 1,100 fish from the lake and was considered a success but that was only a small fraction of the population. In 2010, KLC added a large number of 4- to 6-in. walleyes to the lake. NYDEC has indicated that the walleye is the only species which has been used successfully to control white perch. When walleyes were stocked in 1996, a number of them were found below the dam. They were netted and brought back into the lake. Several techniques are being used to maintain walleyes in the lake.

Each year, for the past fourteen years, KLC has sponsored a 4th of July **"Panfish Derby"** for the children. It provides great fun for everyone. Prizes are given for the number and sizes of fish for three age groups. For several years, the emphasis has been on catch and release - children were encouraged to bring the fish to the launch site alive for counting so they could be released. Since it was difficult to keep large numbers of fish alive, the program was changed in 2005 to give prizes for the smallest fish, the largest 5 panfish and the largest carp, not the largest number of fish. In 2010, the Derby focused on white perch to assist in removing them from the lake. Fishermen were encouraged to keep all the white perch that are caught.

BLACK CRAPPIE , BLUE GILLS AND YELLOW PERCH

Black crappie, blue gills and yellow perch have been a major fish in the lake for many years and, within the past five years, have seemed to increase in abundance and size.

NORTHERN PIKE

For several years following the stocking of 40 yearling northern pike in 1996, a number of stocked fish were caught but then, for several years, very few were caught. For the past five years increasing numbers of 2 and 3-ft. fish are being caught which indicates that they are breeding in the lake. Since they consume white perch and have been seen racing through white perch schools on the surface, they may be assisting in reducing the white perch population.

CARP, SUCKERS AND EELS

Other fish in the lake are the **German or Common Carp** and, to a lesser degree, the scaleless **Israeli or Leather Carp, White Suckers and American Eels.** In fact, the population of 2- to 3-ft. carp is extremely large. Their gigantic appetites for all kinds of soft food may be one reason the weed population has declined over the past few years. It is important to realize that they eat the equivalent of 20% of their body-weight each day. Normally, they eat mollusks, crustaceans and green algae and forage on the bottom for organic material. Sometimes they feed along shorelines but often large numbers can be seen within weed-beds, tearing the weeds up from the roots and eating them on the surface. Common carp are not known for feeding on growing plants but Israeli carp are stocked in ponds to consume both filamentous algae and plants. In late June/early July, when curlyleaf pondweed and water-milfoil die back, carp are seen congregating and feeding in those beds. However, when bushy pondweed begins to grow along shore-lines in July and August, the carp often move into those areas.

In spite of the fact that both varieties are bottom feeders and are blamed for generating silty, cloudy water, microscopic analysis of the water since the alum program was begun in 2001 has revealed that it contains very little inert silt; low water clarity is due primarily to algae and zooplankton. Thus, the high carp population in Kinderhook Lake may be beneficial and not as threatening as previously imagined.

BOATING AND WATER SAFETY

Watercraft congestion is beginning to be a problem on Kinderhook Lake, particularly on week-ends. The number and sizes of engines on powerboats and jet skis have increased dramatically over the past fifteen years and some travel at excessive speeds. In negotiating with NYDEC regarding a public launch site in 1998, KLC Directors insisted that no public site be provided by the State for power-boats. Corporation members can purchase a key to the KLC power-boat launch for $10.00. However, even though the bridge over the channel on Rt 28 was raised in 2005, some boats still cannot get under it and must be launched at other sites. A number of such sites are available to the public, but none have provisions for automobile or trailer parking and, therefore, are used primarily by local residents who can return vehicles to their homes.

For many years, KLC has emphasized water safety in its Newsletter and in its general meetings. For four years, a **Coast Guard Water Safety Course** has been sponsored by KLC and the Lake Improvment Association to provide instruction and water-craft operating permits. In addition, the local Sheriff has been encouraged to monitor the lake and has purchased a jet-ski to do that. However, water craft speeds close to shorelines are still too high; shoreline erosion, damage to moored water craft and personal injury may increase unless additional actions are taken.

SHORELINE EROSION

With increased power-boat and jet ski traffic, wave action is producing serious erosion along some shorelines. Bulkheads of timbers or concrete have been constructed over the years to slow the process but a number of these are now in poor repair and the timbers themselves are being dislodged. Since the shoreline is classified as a wetland, permits are required to repair or replace bulkheads or to protect the shore with stones. A number of residents have been fined by NYDEC for not obtaining proper permits and a number of applications have been declined. Many residents feel that NYDEC is more concerned about wetland regulations than the eroding shorelines. Many have decided to do nothing rather than be rejected or fined. A better understanding must be reached with NYDEC regarding this issue or erosion will become an even more serious concern. Several years ago, a petition was circulated to discontinue the winter drawdown because it was affecting the fish poulations. As pointed out above, fish populations have been affected by the drawdown but the number of fish in the lake is extremely high and there has been no evidence of excessive dead fish in the Spring. Since a primary reason for the drawdown is to minimize shoreline damage and erosion due to ice expansion in the winter and flooding in the spring, KLC will continue to attempt to perform the annual drawdown.

DAM SECURITY

Beginning in 2005, vandalism increased at the boat launch site and at the gates leading to the dam. No Trespassing, No Swimming and Private Property signs have been removed by vandals, hinges on two of the gates were removed and multiple locks have been cut off to gain access to the dam and the lake. In 2011, wood was pounded into the key section of the lock to prevent those with keys from opening the gate. In 2012, locks were crushed and stolen and thick chains were cut to gain entrance to the lake. It seems that some individuals will stop at nothing to gain entrance without puchasing a key. Security cameras may have to be installed to identify the guilty parties.

In order to protect the gate mechanism on the dam, a two-foot diameter thick plastic covering was constructed around the crank area in 2007. Extended fencing and gates were installed to improve security in 2008 and 2012. State Police have been notified and have increased surveilance.

COOPERATIVE PROGRAMS

In addition to participating in **New York State Lakes Conferences (FOLA)**, KLC Directors began meeting with **Columbia County Coalition of Lakes** members seven years ago to share information and develop cooperative programs and have met with officers of the **Nassau Lake Improvement Association** to develop cooperative programs.

LAKE MANAGEMENT PLANS

THE NIVERS DAM

With coffer steel plates driven into bedrock across the entire front face of the dam, it is secure for many years. However, the exhaust pipe on the gate has eroded and the downstream side of both the main spillway as well as the emergency spillway need to be refaced and filled in. The KLC Board has requested a Permit from NYDEC to block water flow through the gate during the winter of 2012 so the exaust area can be inspected and repaired. Following that, downstream refacing will be addressed.

DAM SECURITY

KLC will continue to attempt to monitor and protect the dam and launch from vandalism. Security cameras may have to be installed at the launch site to apprehend those who cut and damage the locks on the gate.

WATERSHED

Phosphate levels in the deep regions of the lake and the inlet will continue to be monitored to determine if alum additions are needed. KLC will continue to work with the Nassau Improvement Association to improve water quality in their lake and to monitor the quality of water flowing into Kinderhook Lake.

SURFACE RUNOFF AND SEPTIC SYSTEMS

KLC will continue to emphasize in the Newsletter that owners should: 1) limit the use of fertilizers on lawns and gardens and provide a border of nutrient-absorbing plants along their shorelines, 2) not rake or burn leaves in the lake following drawdown and 3) have their septic tanks cleaned at least every two years. If cattle-farming is continued at the South end, discussions should be initiated with the State Highway Department to install a containment system.

AQUATIC PLANT CONTROL

Aquatic weed growth will continue to be monitored and the applicaion of a herbicide to control growth if it becomes excessive. Mechanical cutting of water chestnut leaflets will be continued.

FLOATING BOGS

Attempts to irradicate bogs by cutting will be continued until none appear.

FISH STOCKING

KLC will continue to stock walleys and large-mouth bass in the lake and will continue to encourage NYDEC to initiate walleye stocking. NYDEC has stocked tiger muskies in the lake for several years to decrease the white perch population but very few have been caught. Fishing contests may be neccessary to bring down the white perch population.

BOATING AND SAFETY

1) Residents will be reminded repeatedly in the Newsletter to operate water craft safely.
2) The Sheriff's Office will be requested each year to monitor the lake.
3) More signs will be posted regarding speeds close to shorelines and swimming areas.

SHORELINE EROSION

KLC will continue to perform winter drawdowns to minimize shoreline damage and erosion. Shoreline residents will continue to be encouraged to have their septic tanks punped every two years and to have their systems repaired if not functioning properly.

CONCLUSION

In 2012, the lake is entirely different than it was in 1997. When this report was first issued: the cutter boat had to cut paths through curly-leaf pondweeds for many to get into the lake, the lake was covered with unsightly blue-green scum in July and August, water chestnuts covered the north-end bays and water was leaking through the old cobblestone section of the dam. Today, all of those issues have been resolved and the lake is beautiful. We are fortunate to have many shoreline residents, as well as off-lake members, who provide encouragement, manpower and financial support. We, the Directors of KLC, are very appreciative of that support and hope that Kinderhook Lake continues to improve as a beautiful, natural resource.

Board of Directors
Kinderhook Lake Corporation