

**AN AQUATIC PLANT ASSESSMENT OF  
COSSAYUNA LAKE  
WASHINGTON COUNTY, NEW YORK**

prepared for

The Cossayuna Lake Watershed Management Committee

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### Appendix I. Survey Results

## **Executive Summary**

Dense growth of native aquatic plants has been reported for many years in Cossayuna Lake, Washington County, New York. Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive exotic plant species, was first reported in Cossayuna Lake in 1975. While a survey of all aquatic plants in Cossayuna Lake has not been completed since 1948, estimates of abundance of Eurasian watermilfoil indicate an extensive growth of this nuisance species.

In 1970, a management program keyed to winter drawdown, mechanical harvesting and herbicide treatments for aquatic plant control was initiated under the auspices of the Cossayuna Lake Improvement Association. This program continues to the present day.

In 1998, an Aquatic Plant Survey of Cossayuna Lake was commissioned by the Washington County Soil and Water Conservation District and the Cossayuna Lake Improvement Association. The survey was conducted by the Darrin Fresh Water Institute and the New York State Department of Environmental Conservation. The survey was completed on September 9, 1998. The focus of the survey was to document the relative abundance of Eurasian watermilfoil and native aquatic plants. The findings of this survey form the basis of the current report.

## **Findings**

1. A total of 14 aquatic plant species were observed in Cossayuna Lake in 1998. Of these species, the dominant plants were *Myriophyllum spicatum*, *Ceratophyllum demersum*, *Potamogeton crispus*, *Potamogeton robbinsii*, and *Vallisneria americana*. This diversity is below average for lakes of this type in New York State, which can be attributed to the invasion of Eurasian watermilfoil.
2. Eurasian watermilfoil (*Myriophyllum spicatum*) was the most abundant species in Cossayuna Lake, by relative percent cover and the 2nd most abundant by frequency of occurrence on the survey transects.
3. Eurasian watermilfoil was found from the waters edge to water depths of 3.0 meters (10 feet). Milfoil reaches its maximum abundance in water depths of 1.0 to 2.0 meters (3 to 7 feet), and currently covers an extensive area of the lake surface.
3. At the current time, dense growth of Eurasian watermilfoil covers 150 acres of the littoral zone of Cossayuna Lake or about 19% of the surface area of the lake. Scattered growth of Eurasian watermilfoil, however is found throughout the lake.

## **Introduction**

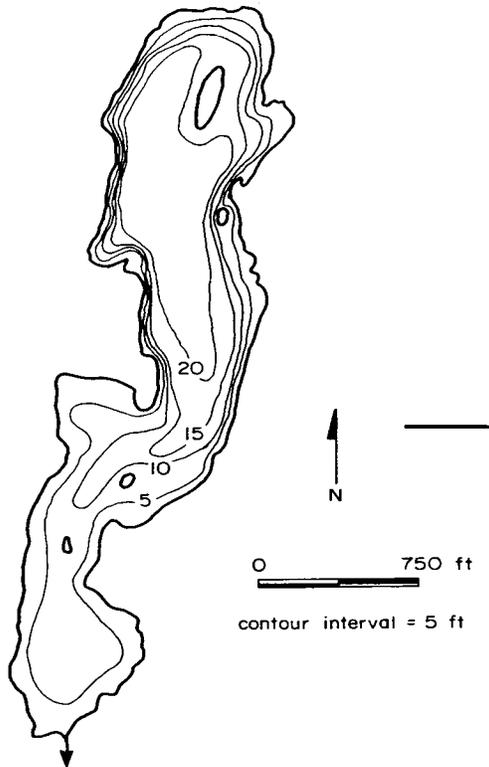
Dense growth of native aquatic plants has been reported for many years in Cossayuna Lake, Washington County, New York. Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive exotic plant species, was reported in Cossayuna Lake in 1975. While a survey of all aquatic plants in Cossayuna Lake has not been completed since 1948, estimates of abundance of Eurasian watermilfoil indicate an extensive growth of this nuisance species. In 1970, a management program keyed to winter drawdown, mechanical harvesting and herbicide treatments for aquatic plant control was initiated under the auspices of the Cossayuna Lake Improvement Association.

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## Background

Cossayuna Lake is located in the central portion of Washington County in the Towns of Argyle and Greenwich. Elevations within the watershed range from 495 feet above sea level at the surface of the lake to 900 feet at the highest elevations.

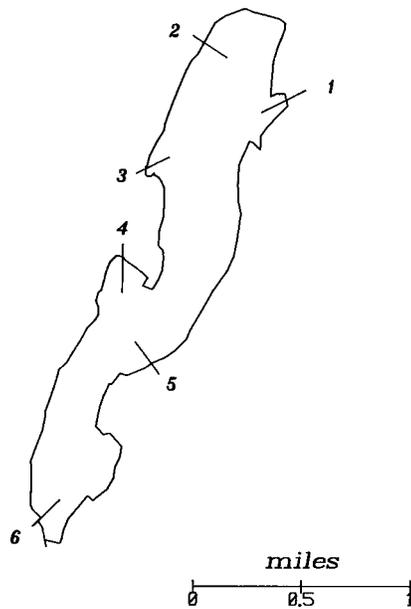
**Figure 1. Depth Map of Cossayuna Lake**  
**Cossayuna Lake**



The lake has a surface area of 776 acres and a rolling watershed of 7,467 acres. It drains via Whittaker Creek to the Battenkill and ultimately the Hudson River. The lake has a maximum depth of 8.0 meters (26 feet) and a mean depth of 3.1 meters (10 feet). Typical of lakes in the temperate region, it is dimictic, exhibiting both summer and winter thermal stratification. Located on the southern margin is the only outlet which is dammed and used to maintain the level of the lake. The lake is best classified as eutrophic which indicates that nutrients necessary for dense growth of algae and subsequently the myriad of organisms that feed on these plants, are available.

The surficial geology is primarily glacial till, a sand and gravel soil without exposed bedrock. The soil associations are Nassau, and Bernardson series consisting of loam, fine sands and cobblestones. Drainage in these deposits is rapid and their ability to furnish lime, nitrogen and phosphorus to terrestrial plants is moderate.

# COSSAYUNA LAKE



**Figure 2. Map of transects for Cossayuna Lake.**

Cossayuna Lake is a residential/recreational lake with boating, fishing and swimming as the primary uses. Public access is available via a launch ramp maintained by the NYS Department of Environmental Conservation.

## Methods

To quantify the aquatic plant populations present in the lake, six transects were located around the lake shoreline (Figure 2). All aquatic plant species and their relative abundance were recorded at one meter depth intervals along each transect, using the following abundance classes: abundant (greater than 50% cover), common (25 to 50% cover), present (15 to 25% cover), occasional (5% to 15% cover) and rare (less than 5% cover). These data both provide average depth distributions of plants, and an estimate of the relative abundance of all species in the lake.

The location of scattered and dense Eurasian watermilfoil (*Myriophyllum spicatum* L.) populations for the entire lake were also recorded.

## Submersed Plant Species

Aquatic plant species present and their relative abundance were recorded for six transects for Cossayuna Lake, Washington County, New York. A list of all submersed and floating-leafed aquatic plant species observed is given in Table 1. A total of 14 species were observed. Of these, one genera is a macroscopic alga, or charophyte (*Chara/Nitella*), one is totally floating (*Lemna*), two are floating-leafed species (*Nuphar* and *Nymphaea*), one is an emergent species (*Typha*) and the remaining 9 are submersed.

The number of species observed indicates slightly lower diversity than other low-elevation Northeastern lakes (Madsen et al. 1989). For instance, Lake George has 47 submersed species (RFWI et al., 1988) and 28 were observed in Lake Luzerne in 1989 (Eichler and Madsen, 1990a). In both of these lakes, high diversity is threatened by further growth and expansion of an exotic plant species, Eurasian watermilfoil, which will have negative implications for the health of the lakes as a whole (Madsen et al., 1989; 1990b).

The composition of the species list for Cossayuna Lake was similar to that of other nearby lakes. For instance, all of the species observed in Cossayuna Lake have been noted for other regional lakes (Ogden et al, 1973; Madsen et al., 1989). Fifteen species are typical for a lake of this type (low elevation, eutrophic) in New York State (Taggett and Boylen, 1990).

Surveys of aquatic plants in Cossayuna Lake were conducted in 1932 (Muenscher, 1933), 1948 (NYSDEC Fisheries), 1992 (CSLAP, 1992) and the current survey in 1998. The species lists for the four surveys are quite different. Historical surveys of Cossayuna Lake indicate a greater diversity of aquatic plants than is currently seen. Munscher (1933) observed 30 species of aquatic plants in Cossayuna Lake. Five aquatic plant species were reported in 1992, while the current survey reported 14 species. Between the four surveys, a total of 35 species of aquatic plants are reported for Cossayuna Lake. The loss of diversity may be attributable to the introduction and spread of Eurasian watermilfoil. First verified in Cossayuna Lake in 1975, Eurasian watermilfoil is currently one of the dominant aquatic plant species. Case histories from throughout the US and Canada indicate a loss of species diversity following invasion by Eurasian watermilfoil. Only a limited number of native plant species can survive under a canopy of Eurasian watermilfoil.

Some of the differences among the surveys are in the less common and emergent species. Emergent species may have been intentionally excluded from past surveys due to their presence at water's edge rather than submersed. For instance, *Typha latifolia* or cattail is a common emergent species, generally associated with marshlands peripheral to the lake. Cattails were not reported prior to 1998.

Species richness may be linked to bottom slope and sediment type. The site in Cossayuna Lake with the greatest amount of fine-grained sediment (silts) was associated with the major tributary (Inlet). This site supported more diverse aquatic plant populations. Steep-sloping sites with coarse sediments were typical of the west shore, and generally yielded limited species richness.

None of the plant species observed in Cossayuna are on the New York State Rare Plant list (Mitchell, 1986; Clemants, 1989; Young, 1992). The lack of rare plants simplifies aquatic plant management decisions.

**Table 1. Cossayuna Lake Aquatic Plant Surveys**

<b>Scientific Name</b>	<b>Common Name</b>	<b>1932</b>	<b>1992</b>	<b>1998</b>
<i>Bidens beckii</i>	Water Marigold	x		
<i>Brasenia schreberi</i>	Water Shield	x		
<i>Ceratophyllum demersum</i>	Coontail	x	x	x
<i>Eleocharis sp.</i>	Spikerush	x		
<i>Elodea canadensis</i>	Waterwort	x	x	x
<i>Heteranthera dubia</i>	Water Stargrass	x		x
<i>Isoetes echinospora</i>	Quillwort	x		
<i>Lemna</i>	Duckweed			x
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil		x	x
<i>Najas flexilis</i>	Water Naiad	x		x
<i>Nuphar luteum</i>	Yellow Water Lily	x	x	x
<i>Nymphaea odorata</i>	White Water Lily	x		x
<i>Pontederia cordata</i>	Pickerelweed	x		
<i>Potamogeton americanus</i>	Long leaved Pondweed	x		

<i>Potamogeton amplifolius</i>	Broad leaved Pondweed	x		
<i>Potamogeton crispus</i>	Curly Leaf Pondweed	x	x	x
<i>Potamogeton dimorphus</i>	Spiral Pondweed	x		
<i>Potamogeton epihydrus</i>	Nuttall's Pondweed	x		
<i>Potamogeton freisii</i>	Fries' Pondweed	x		
<i>Potamogeton gramineus</i>	Variable Pondweed	x		
<i>Potamogeton natans</i>	Floating Pondweed	x		
<i>Potamogeton pectinatus</i>	Sago Pondweed	x		
<i>Potamogeton praelongus</i>	White-stemmed Pondweed	x		
<i>Potamogeton pusillus</i>	Little Pondweed	x		x
<i>Potamogeton richardsonii</i>	Richardson's Pondweed	x		
<i>Potamogeton robbinsii</i>	Robbin's Pondweed	x		x
<i>Potamogeton zosteriformes</i>	Flat Stem Pondweed			x
<i>Ranunculus sp.</i>	Crowfoot	x		
<i>Sparganium eurycarpum</i>	Giant Bur-reed	x		
<i>Typha sp.</i>	Cattail			x
<i>Utricularia vulgaris</i>	Giant Bladderwort	x		
<i>Vallisneria americana</i>	Eelgrass	x		x

1992 SURVEY VIA CSLAP

## Vegetation Transects

The locations of the six transects examined are indicated in Figure 2, Table 2. Sites were selected that had both shallow and moderately steep slopes, and sediment conditions ranging from sand and gravel to soft silt. The survey was conducted on September 9, 1998. Aquatic plant presence and relative abundance for all transects are included as Appendix I.

**Table 2. Transect information for Cossayuna Lake.**

Transect #	Name	Slope	Sediment Type
1	Boat Launch	Flat	Soft Silt
2	Northwest Cove	Moderate	Sand and gravel
3	Little Troy Bay	Gradual	Soft Silt
4	Turtle Cove	Gradual	Soft Silt
5	Little Island	Gradual	Sand and silt
6	Inlet	Gradual	Silt

### Transects

Transect 1 was located at the NYS DEC operated boat launch ramp on the northeast shore of the lake (Figure 2). This site was characterized by soft silty sediment to a maximum depth of 3 meters. Bottom slope was gradual. Four species were found in depths from 0 to 5 meters. The vegetation was dominated by native aquatic plants in depths of 0 to 1 meters with coontail (*Ceratophyllum demersum*) dominating. Eurasian watermilfoil (*Myriophyllum spicatum*) was found to a depth of 1 meter.

Transect 2 was located on the northwest shoreline across from the large island. Sediments were a sand/silt mixture with a gradual slope. A total of 8 species were represented. *Vallisneria americana* dominated in shallow waters, 0 to 1 meters depth. Dense growth of Eurasian watermilfoil (*Myriophyllum spicatum*) was found at this site at depths of 1 to 2 meters. Curly leaf Pondweed (*P. crispus*) was common in depths of 2 to 3 meters. No aquatic plants were observed beyond 3 meters.

Transect 3 was located on the western shore of Little Troy Bay. Bottom slope was gradual and sediment was mainly soft silt. Maximum depth surveyed was 3 meters. Emergent and floating-leaved species were common, including *Typha*, *Nuphar luteum* and *Nymphaea odorata*. Eurasian watermilfoil (*Myriophyllum spicatum*) dominated the plant community in water depths of 0 to 2 meters. Curly leaf Pondweed (*P. crispus*) was common in depths of 2 to 3 meters. No aquatic plants were observed beyond 3 meters.

Transect 4 was located in Turtle Cove. Slope at this site was gradual with silts and detrital materials predominant. Vegetation in depths less than 3 meters was dominated by Eurasian milfoil (*Myriophyllum spicatum*) and coontail (*Ceratophyllum demersum*). Extensive filamentous algae growth also was observed in this area. Maximum diversity was observed between 1 and 2 meters depth with 6 species present. No macrophytes were observed beyond a depth of 3 meters.

Transect 5 was located in a small bay on the southeastern shoreline. Bottom slope at this site was gradual. Maximum depth surveyed was 3 meters. Species diversity was moderate at this location, with 5 to 6 species per depth interval, typical. Eelgrass (*Vallisneria americana*) was dominant in shallow waters (less than 2 meters). An extensive area of scattered growth of Eurasian watermilfoil (*Myriophyllum spicatum*) was found at this site.

Transect 6 was located at the inlet from Summit Lake. Sediments at this location were mainly silt and bottom slope was nearly flat. Eight species were found in water depths less than 1 meter, with the bottom cover dominated by *Ceratophyllum demersum*. Beyond a depth of 2 meters, *Myriophyllum spicatum* was dominant. Maximum depth at this site was 3 meters.

### Summary

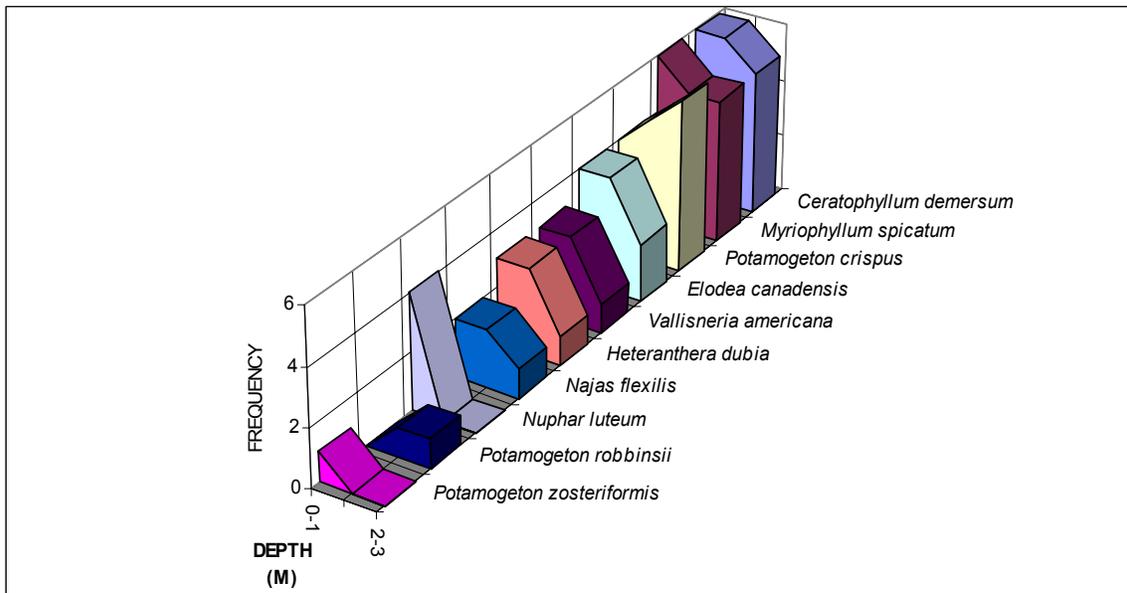
The ten most common species of aquatic plants by frequency of occurrence in Cossayuna Lake are described by depth distribution in Figure 3 and Table 3. Coontail (*Ceratophyllum demersum*) was the most common aquatic plant. Coontail is only weakly rooted, frequently growing without any attachment to the lake bottom. This species draws all of its' nutrition from the water column, thus serving a valuable function in reducing the concentrations of nutrients in the water column and competing directly with planktonic algae.

**Table 3. Frequency of occurrence of the dominant species in Cossayuna Lake.**

Species	Depth in Meters			Total (n=18)
	0-1 (n=6)	1-2 (n=6)	2-3 (n=6)	
<i>Ceratophyllum demersum</i>	6	6	5	17
<i>Myriophyllum spicatum</i>	6	5	5	16
<i>Potamogeton crispus</i>	4	5	6	15
<i>Elodea canadensis</i>	4	4	2	10
<i>Vallisneria americana</i>	3	3	1	7
<i>Heteranthera dubia</i>	3	3	1	7
<i>Najas flexilis</i>	2	2	1	5
<i>Nuphar luteum</i>	4			4
<i>Potamogeton robbinsii</i>	0	1	1	2
<i>Typha</i>	2			2
<i>Lemna</i>	1			1
<i>Nymphaea odorata</i>	1			1
<i>Potamogeton zosteriformis</i>	1			1
<i>Potamogeton pusillus</i>	1			1

Eurasian watermilfoil (*M. spicatum*) was the second most common macrophyte by frequency of occurrence, followed by Curly leaf pondweed and Elodea. Frequency of

**Figure 3. Frequency of occurrence of the most common species in Cossayuna Lake.**



occurrence is based on presence at each transect and depth interval surveyed. Maximum species diversity was found from the waters edge to a depth of 1 meter. Certain species howed a depth preference, with *Myriophyllum spicatum*, *Ceratophyllum demersum* and

*Elodea canadensis* dominating in depths of 2 meter or less. *Potamogeton crispus* and *Potamogeton robbinsii* were more common between 2 and 3 meters depth. Beyond a depth of 3 meters no aquatic plants were present. This defines the maximum depth of the littoral zone as 3 meters.

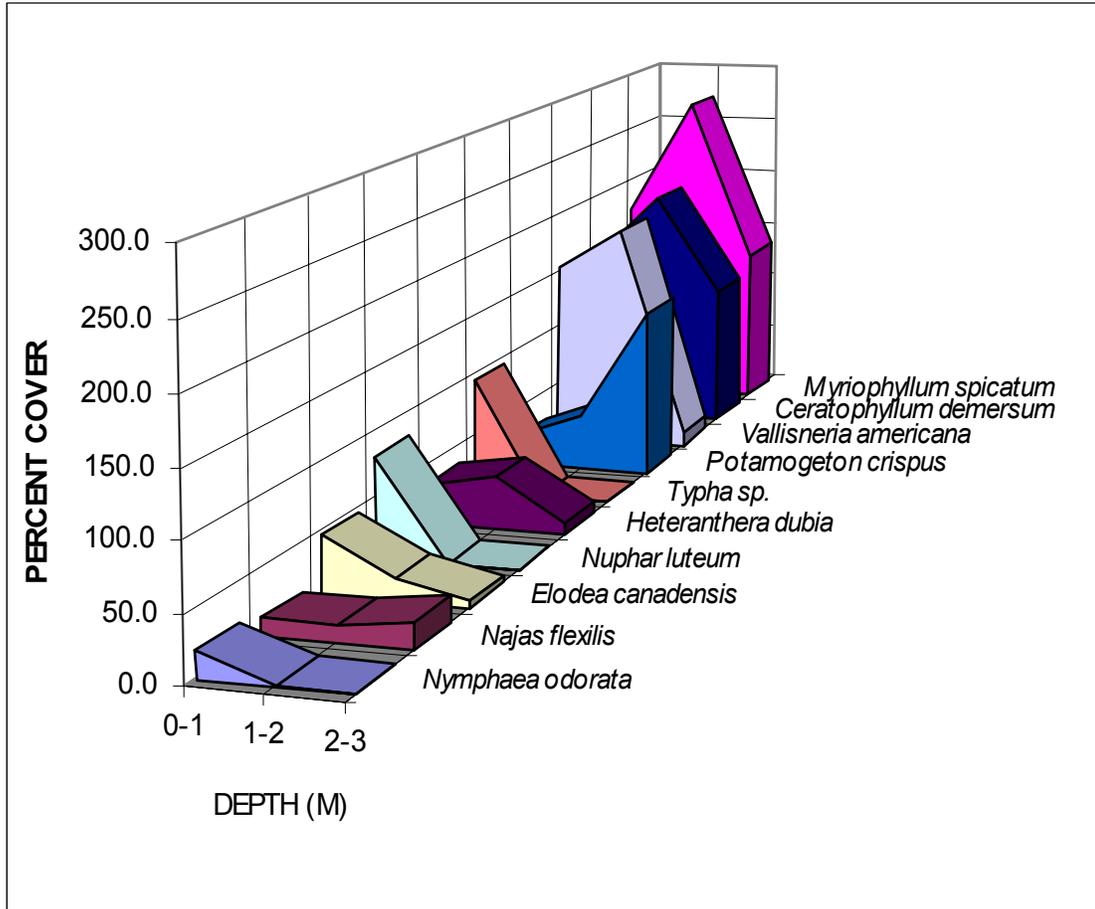
**Table 4. Average percent cover for the dominant species in Cossayuna Lake.**

<u>Species</u>	<u>Depth in meters</u>			<u>Total</u>
	<u>0-1</u>	<u>1-2</u>	<u>2-3</u>	
<i>Myriophyllum spicatum</i>	172.5	272.5	132.5	577.5
<i>Ceratophyllum demersum</i>	145	200	117.5	462.5
<i>Vallisneria americana</i>	152.5	187.5	10	350
<i>Potamogeton crispus</i>	25	45	137.5	207.5
<i>Typha</i>	95			95
<i>Heteranthera dubia</i>	32.5	42.5	10	85
<i>Nuphar luteum</i>	80			80
<i>Elodea canadensis</i>	45	17.5	5	67.5
<i>Najas flexilis</i>	12.5	12.5	20	45
<i>Nymphaea odorata</i>	20			20
<i>Potamogeton robbinsii</i>	0	2.5	10	12.5
<i>Lemna</i>	2.5			2.5
<i>Potamogeton pusillus</i>	2.5			2.5
<i>Potamogeton zosteriformes</i>	2.5			2.5

Average percent cover for all species is shown in Table 4. The top ten species are described in Figure 4. Eurasian watermilfoil (*Myriophyllum spicatum*) was the most common macrophyte species followed in abundance by *Ceratophyllum demersum*, *Vallisneria americana*, and *Potamogeton crispus*. The top species are the same as those recorded for frequency of occurrence.

Variability in the aquatic plant community between sampling locations was attributable to specific site conditions such as sediment type and slope. The plant communities throughout Cossayuna Lake were similar with few exceptions. Several species were limited to a single transect, however these species generally were rare in occurrence even where they were found.

Figure 4. Average percent cover of the most common species in Cossayuna Lake.



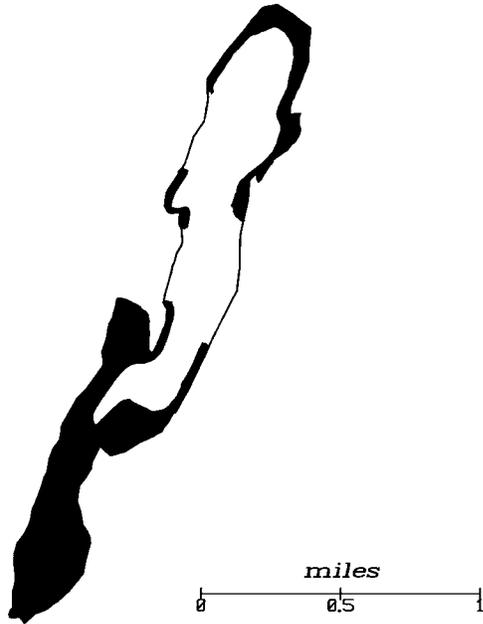
## Eurasian watermilfoil in Cossayuna Lake

Eurasian watermilfoil plants were found throughout the littoral (area of rooted aquatic plants) zone of Cossayuna Lake (Figure 5). The depth distribution of Eurasian watermilfoil (see Table 3) indicates that this species is present from the water's edge to a depth of 3 meters. Eurasian watermilfoil reached its maximum abundance in waters of 1 to 3 meters depth. At the current time, Eurasian watermilfoil is a major component of the overall aquatic plant population of Cossayuna Lake, nearly forming a ring around the shoreline of the lake.

Most of the littoral zone of the lake supports dense populations of Eurasian watermilfoil. Several areas have sand or rocky bottom sediments, which do not support dense growth of any of the other aquatic plants species observed in Cossayuna Lake. Most areas with sediment types and depth ranges acceptable for growth of Eurasian watermilfoil support some growth of this plant. It was observed at all transects surveyed.

**Figure 5. Locations of dense growth of Eurasian watermilfoil in Cossayuna Lake.**

MILFOIL BEDS



At the current time, dense growth of Eurasian watermilfoil covers 150 acres of the littoral zone of Cossayuna Lake or about 19% of the surface area of the lake. Scattered growth of Eurasian watermilfoil, however is found throughout the lake. This species is an invasive exotic plant, which has been found to impair ecosystem function in a number of regional lakes. Explosive growth of Eurasian watermilfoil (*Myriophyllum spicatum*) can out-compete native plants, alter habitats and food resources and interfere with recreational use of water bodies. Control programs are underway in the lake, utilizing physical, mechanical and chemical control agents.

## **Management of Eurasian Watermilfoil in Cossayuna Lake**

Although lake residents all want immediate action, the first step in addressing Eurasian watermilfoil problems in Cossayuna Lake is to develop a long-term aquatic plant management plan as a component of an overall lake management plan. A long-term plan is needed, since it is unlikely (if not impossible) that Eurasian watermilfoil can be eradicated from the lake. Even if eradication were to be accomplished, continued vigilance would be necessary to prevent any future re-introductions.

Some specific components to address in any aquatic plant management plan are:

- Education**
- Prevention**
- Implementation of Controls**
- Evaluation and Monitoring**

**Education.** Education of lake-users and homeowners is imperative to develop support for management efforts, and to gather volunteers to assist with the program. Homeowners and lake-users must have a basic understanding of nuisance aquatic plants such as Eurasian watermilfoil and how to prevent further introductions and spread. One fact is becoming clear, in these times of limited funding opportunities, the only way to protect your lake is to join forces and do it as a lake association. In addition to educational materials, surveys also provide insights into the issues and priorities of the lake-users. Periodic surveys of property owners and recreational users can define the needs of any management program. The surveys also indicate the level of support or resistance for management efforts, information which is critical to the permitting process for management efforts.

**Prevention.** Once control has been successful, efforts must be made to prevent reintroduction, and slow the spread of Eurasian watermilfoil. Also, preventive efforts will help to curtail the spread of this plant to other lakes; both as an altruistic measure to keep other lakes from experiencing these problems, and to minimize sources of plants for potential reintroduction of exotic species. Prevention efforts might include education, non-point pollution control, erosion management and encouraging the reintroduction and growth of native plants. Working with the upstream lake associations, county and state agencies is also strongly encouraged. Eurasian watermilfoil is present in lakes (Summit Lake) upstream of Cossayuna Lake; preventing introduction to and from these lakes will benefit Cossayuna Lake.

**Evaluation and Implementation of Controls.** A wide variety of control techniques are available, none of which provides a perfect solution. All techniques have advantages and drawbacks. Each location with Eurasian watermilfoil must be assessed individually, and a control technique selected that will work under those conditions.

The vegetation management committee must study the control options and decide on a suitable group of control techniques. Do not rely solely on consultants to decide for you. One important consideration generally neglected is that these techniques will have to be approved through a permitting process, so select techniques that will be acceptable to the permit administrator. The permits for aquatic plant control within New York State

outside the Adirondack Park are administered by the New York State Department of Environmental Conservation.

Aquatic plant management options fall into 4 major groups:

**Physical - lake level drawdown, hand harvesting or benthic barrier**

**Mechanical - harvesters, dredges and rakes**

**Chemical - herbicides**

**Biological - pathogens, herbivores and parasites**

Of these four categories, only biological, physical and chemical means offer the possibility of long-term reductions in Eurasian watermilfoil growth for Cossayuna Lake. There are currently two viable biological control options: 1). grass carp, a plant eating fish, is approved in New York State and 2) herbivorous insects which include a weevil and an aquatic moth larvae (caterpillar). Grass carp may not be particularly suitable for Cossayuna Lake since they are completely non-selective in their feeding habits, and tend to prefer native vegetation. Generally feeding from the growing tips down the plant, however, they may provide open water areas where aquatic plants currently grow to the surface. Herbivorous insects are experimental at the current time, but appear to have potential for long-term control of Eurasian watermilfoil.

Mechanical controls, while they may be useful in a long-term maintenance program, do not generally eliminate the target plant species from a given area, but simply reduce its abundance to allow recreational use. While raking and harvesting (cutting) provide relief for lakeside residents, longer-term control of Eurasian watermilfoil is generally desired. Mechanical harvesting can also have a side effect of spreading plant fragments during the process of cutting. These fragments may start new populations or increase the density of existing populations. Given the extensive dense growth areas of Eurasian watermilfoil in Cossayuna Lake however, this technique is applicable. Volunteer operated, mechanical harvesters have been active on Cossayuna Lake for a number of years.

Lake level drawdown, a physical control technique, lowers lake water levels in the winter in order to freeze the plants. This technique has had some success on Eurasian watermilfoil control in area lakes, for example, Galway Lake in Saratoga County, NY. The current lake outlet structure on Cossayuna Lake, however, will not allow a sufficient lake level reduction to reach most of the milfoil growing in the lake. This technique may however, have beneficial effects when combined with other techniques in an Aquatic Plant Management Program.

Benthic barriers, fabric stretched over the lake bottom to smother plants, also have been successful for Eurasian watermilfoil control. The extensive areas of Cossayuna Lake dominated by Eurasian watermilfoil, make this technique cost prohibitive. Benthic barriers typically cost from \$15,000 to \$25,000 per acre, installed. Significant cost savings can be achieved by the use of non-typical barrier materials such as belt press cloths, sand and others in place of commercially available benthic barrier materials. Benthic barriers are only recommended for areas of dense growth of Eurasian watermilfoil, primarily due to environmental considerations due to their totally non-

selective nature for aquatic plant control. Small beach areas can benefit from this technique.

Chemical or herbicide application also has potential for Eurasian watermilfoil control in Cossayuna Lake. The large extent of Eurasian watermilfoil growth in Cossayuna Lake warrants consideration of herbicides. Herbicide application is often inexpensive on a per acre basis, when compared to physical plant controls. The time and costs associated with acquiring a permit for herbicide application however need to be factored in the cost. There are a number of herbicides on the market which are used for Eurasian watermilfoil management. The most commonly used and/or recommended include Aqua-Kleen (2,4-D) and Sonar (fluridone). New York State requires that these chemical herbicides be applied by a licensed applicator. The lake association should contact several applicators and get cost estimates on various applications. The information contained in this survey should allow for fairly specific price quotations. All herbicides contain label restrictions for applications rates, proximity to drinking water intakes, contact restrictions for swimming, and toxicity for species other than those targeted. The applicator should be able to provide this type of information. Experience of the lake association with long term herbicide applications is probably the best teacher.

Management Option	Cost per Acre	Limitations
Lake Level Drawdown	\$0	non-selective, limited to depth of outlet structure
Hand Harvesting	\$30,000	limited to low density growth labor intensive
Benthic Barrier	\$20,000	non-selective labor intensive
Herbicide	\$2000	public perception moderate selectivity
Grass Carp	\$400 - \$500	non-selective, turbidity
Insects	\$400 - \$500	some selectivity experimental

**Monitoring and Evaluation.** These two activities are similar in execution, but somewhat distinct in purpose. The vegetation committee should coordinate a lay monitoring program of lake-users to observe lake areas for the presence and spread of Eurasian watermilfoil in the lake. In addition, these individuals might help in posting boat launches and even inspecting boats and interviewing owners about the Eurasian watermilfoil problem.

Monitoring the lake would include consistent visual inspections of areas of the lake, using snorkeling or SCUBA, for the presence and spread of Eurasian watermilfoil. One technique for quantifying areas with dense Eurasian watermilfoil is to use an echolocation unit (“fish/depth locator”) to map the height and area of dense beds during the summer. Currently the Citizens Statewide Lake Assessment Program (CSLAP) collects information on the aquatic plants in a number of New York State lakes.

Continued coordination with the efforts of this program should be encouraged. These monitoring activities should be part of an overall lake monitoring program.

Evaluation activities are designed to examine specific control programs and techniques, as well as assessing the rate of Eurasian watermilfoil regrowth or recolonization and the need for repeated control at a given location. This may be done by lay monitors, or contracted with consultants.

An ongoing effort in prevention, education, evaluation and monitoring will greatly facilitate gathering information and making decisions on future management directions.

### **Findings**

1. A total of 14 aquatic plant species were observed in Cossayuna Lake in 1998. Of these species, the dominant plants were *Myriophyllum spicatum*, *Ceratophyllum demersum*, *Potamogeton crispus*, *Potamogeton robbinsii*, and *Vallisneria americana*. This diversity is below average for lakes of this type in New York State, which can be attributed to the invasion of Eurasian watermilfoil.
2. Eurasian watermilfoil (*Myriophyllum spicatum*) was the most abundant species in Cossayuna Lake, by relative percent cover and the 2nd most abundant by frequency of occurrence on the survey transects.
3. Eurasian watermilfoil was found from the waters edge to water depths of 3.0 meters (10 feet). Milfoil reaches its maximum abundance in water depths of 1.0 to 2.0 meters (3 to 7 feet), and currently covers an extensive area of the lake surface.
3. At the current time, dense growth of Eurasian watermilfoil covers 150 acres of the littoral zone of Cossayuna Lake or about 19% of the surface area of the lake. Scattered growth of Eurasian watermilfoil, however is found throughout the lake.

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## Appendix I. Survey Results

Cossayuna Lake  
Aquatic Plant Survey

Site: All

<u>Species</u>	<u>Depth Interval (m)</u>			<u>Total</u>
	<u>0-1</u>	<u>1-2</u>	<u>2-3</u>	
Ceratophyllum demersum	145.0	200.0	117.5	462.5
Elodea canadensis	45.0	17.5	5.0	67.5
Heteranthera dubia	32.5	42.5	10.0	85.0
Lemna sp.	2.5			2.5
Myriophyllum spicatum	172.5	272.5	132.5	577.5
Najas flexilis	12.5	12.5	20.0	45.0
Nuphar luteum	80.0			80.0
Nymphaea odorata	20.0			20.0
Potamogeton crispus	25.0	45.0	137.5	207.5
Potamogeton pusillus	2.5			2.5
Potamogeton robbinsii		2.5	10.0	12.5
Potamogeton zosteriformes	2.5			2.5
Typha sp.	95.0			95.0
Vallisneria americana	152.5	187.5	10.0	350.0